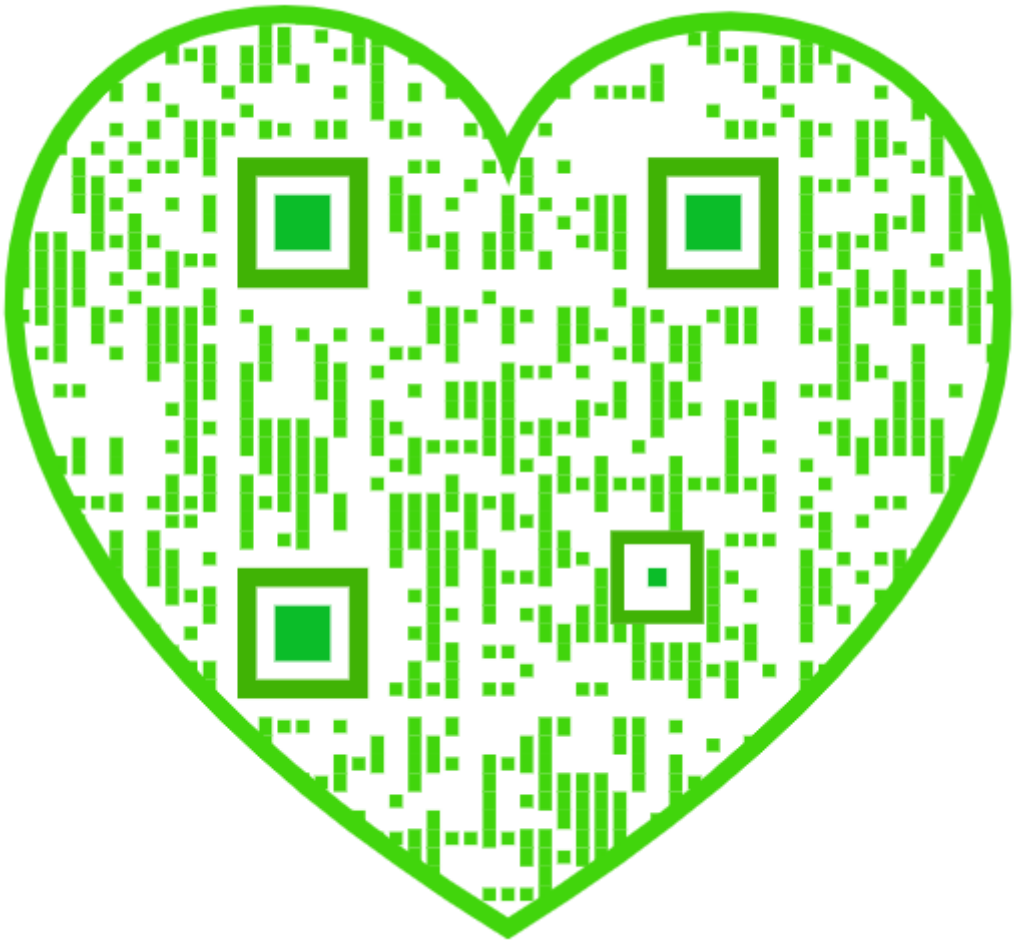
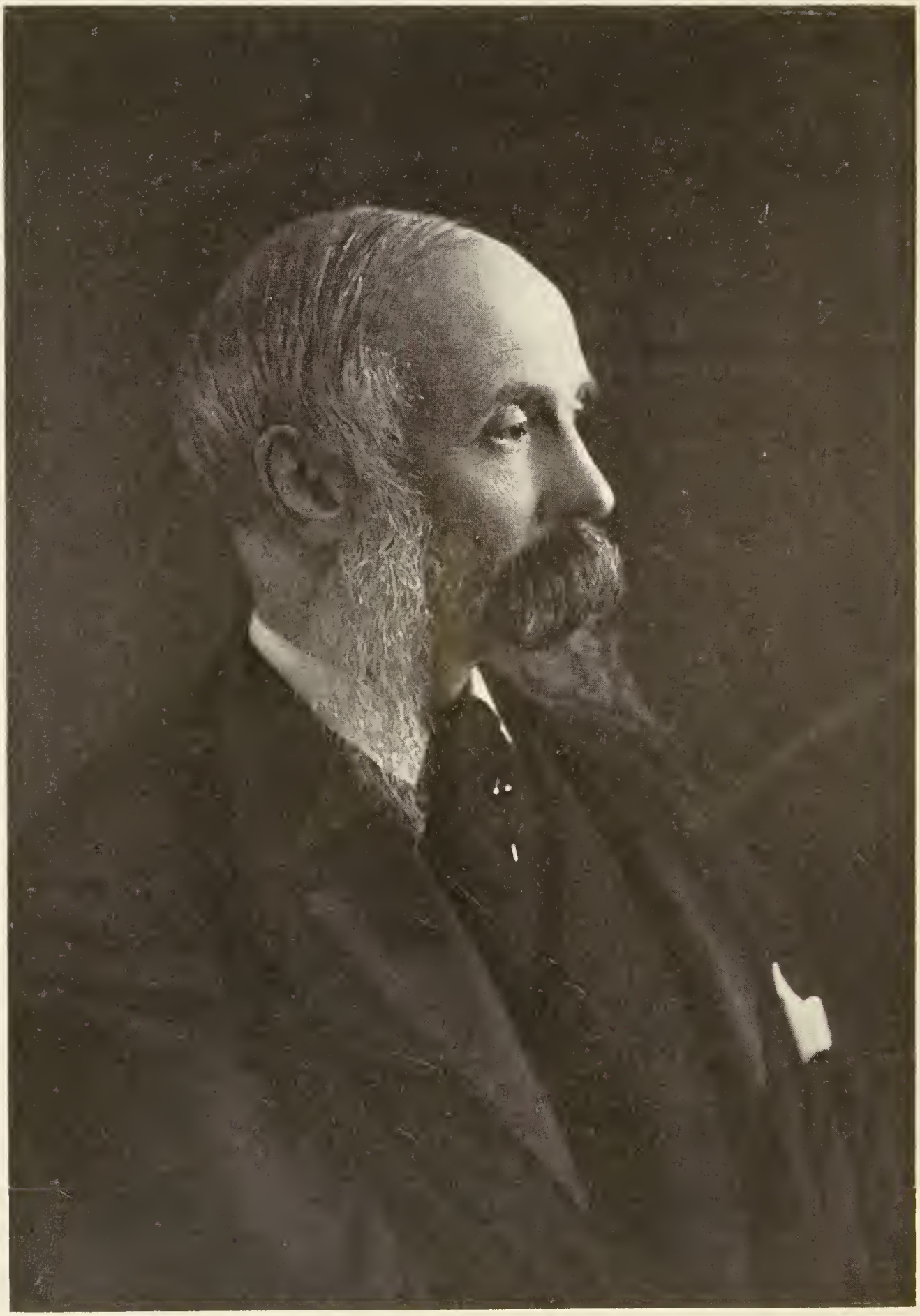
THE RAT PROBLEM

BY

W. R. BOELTER





SIR JAMES CRICHTON-BROWNE, J.P., M.D., LL.D., F.R.S.
President of the Incorporated Society for the Destruction of Vermin.

THE RAT PROBLEM

BY

W. R. BOELTER

Corresponding Member of the Commission Internationale, Association International pour la Destruction Rationnelle des Rats; Member of the Executive Committee of the Incorporated Society for the Destruction of Vermin; Author of "A World's War against the Rat"; "Rats and Agriculture"; "The Danish Rat Law"; "A Lesson in Economic Zoology"; "An Investigation of the Bacilli applied to the Destruction of Rats"; "Household Pests and Household Remedies," &c.

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THE RAT PROBLEM.

INTRODUCTION.

Some years ago I became acquainted with the splendid work which Zuschlag, of Copenhagen, was doing in agitating for the passing of a Danish Rat Law. I read his book, "The Rat and Civilization," and having thereby been induced to become his enthusiastic disciple, I decided to persuade, if I could, the English-speaking world to join in the war of extermination preached day in and day out by this arch-enemy of the rat.

My first article on the subject appeared just twelve months ago. It was entitled "A World's War against the Rat," and gave a summary of the "case for the prosecution." It was fortunate in attracting the attention of Mr. A. E. Moore, C.E., of Paignton, who, himself a sworn enemy of the rat, reprinted my article, sent it out to a number of leading medical men, economic zoologists, and other prominent men, and worked indefatigably until he had succeeded in establishing the Incorporated Society for the Destruction of Vermin.

The object for which this Society is established is, according to its Memorandum of Association (Article 3), "the Destruction of Noxious Vermin, including in particular, without prejudice to others included in the general term of Vermin, Rats, Mice, Sparrows, Ticks, Fleas, Mosquitoes and Flies, and any Parasites."

As regards the rat the Society has adopted the

policy for which I stand, and which I have advocated in numberless periodicals throughout the Empire : to agitate for the passing of a Rat Law on the lines of the Danish Rat Law. A Bill has now been drafted by the Parliamentary Sub-Committee of the Society, and will be introduced into Parliament, it is hoped, at an early date.

The object of this book is to present the case against the rat so completely as to place the passing of this Bill beyond doubt. If the form of my indictment may be found wanting, the evidence against the rat will, I think, prove overwhelming, and secure from every reader a verdict against the rat of "guilty on all counts." And such verdict of the people, finding its expression in the terms of a Rat Law, will mean for the British Empire the saving from needless destruction of millions of pounds worth of property and of untold human life.

I am indebted to the University Press, Cambridge, for permission to use figs. 41, 44 and 46, from "Treatise on Plague," by Prof. Simpson ; to Messrs. Longmans, Green and Co. for the illustration of Bishop Hatto's tower, from "Curious Myths of the Middle Ages," by S. Baring-Gould ; to Messrs. Baillière, Tindall and Cox for figs. 38 and 39, from "Parasites and Parasitic Diseases of Domestic Animals" ; to T. Pridgin Teale, Esq., for the illustration on page 70, from "Dangers to Health" ; to the Editor of *World's Work* and the Proprietors of the *Strand Magazine* for permission to reproduce the photographs, pages 111, 114 and 115 ; to the Trustees of the British Museum and to the Trustees of the

Parkes Museum, for permission to photograph a number of exhibits ; and to the Association Internationale pour la Destruction Rationnelle des Rats for the loan of photographs and caricatures.

W. R. Boelter.

STATUE OF THE CAT-GODDESS BAST, WITH FOUR STATUETTES OF CATS.

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CHAPTER I.

Natural History of the Rat.

There is no animal more widely known or more persistently hunted down than the brown rat (*Mus norvegicus*, formerly *Mus decumanus*), also called the Hanoverian[1] rat. Wherever man is found there rats will be found too, devouring and spoiling food and gnawing and destroying material. Nothing is safe from their sharp teeth. They find their way everywhere—no door is shut to them ; they burrow and gnaw through almost any obstacles, not excepting bricks, lead, zinc and stone. Measuring about 8 inches in length, not including the tail, which is usually shorter than the body, agile and strong, able to run fast, jump high, swim long distances. and climb almost any object, using its tail to the

---

[1] "There is, so far, a justification for the name 'Hanoverian Rat,'" says Waterton in his "Natural History," "in that the animal seems to have reached this country about the year 1728. There is a tradition current in this part of the country (Yorkshire) that the insatiate and mischievous little brute came over in the same ship which conveyed the new dynasty to these shores. My father, who was one of the first order of field naturalists, was always positive upon this point, and he maintained firmly that it did accompany the 'House of Hanover' in its emigration from Germany to England."

There is, however, no reason for calling it the Norway rat. The scientific name *norvegicus* is given under the zoological law that each animal shall bear the name first given to it ; and as the brown rat was first called the Norway rat, we must now call it *Mus norvegicus*—on the principle of *lucus a non lucendo*—and translate *norvegicus* by "brown."

THE BROWN RAT, *Mus norvegicus* (*decumanus*).

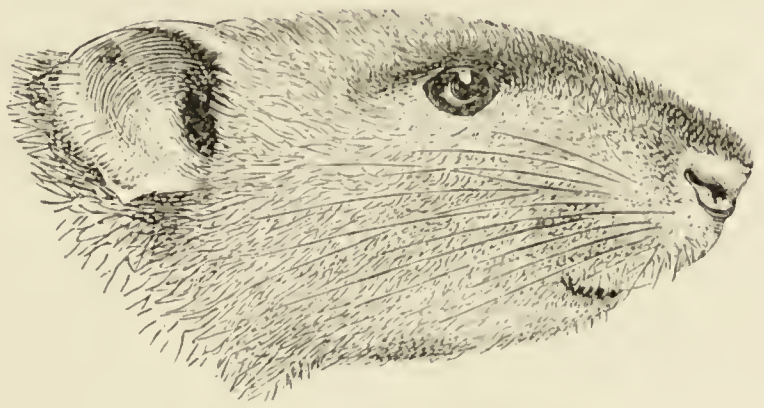
utmost advantage; with a fur of greyish-brown colour eminently suited to their stealthy nocturnal habits; shy singly, but savage, fierce and blood-thirsty in numbers, the brown rat has, aided by an incredible fecundity,[2] within two centuries overrun the world.

Migrating, in the middle of the eighteenth century, from Asia into Europe, it met on its march westward the

[2] They bear four or five times a year from four to ten blind and naked young, which are in their turn able to breed at the age of 6 months, the time of gestation being about twenty days. See also Fecundity table, p. 88.

THE BROWN RAT. (AFTER BELL.)

black rat (*Mus rattus*). Then ensued a fight for life and death, which has already ended in the almost total destruction of the smaller and less savage animal,[3] leaving the brown rat the undisputed victor.



HEAD OF BROWN RAT.

[3] The following anecdote, related by Buckland, illustrates in a striking manner the superior power and, at the same time, ferocity of the brown rat. "A London rat-catcher shut up together in a cage the results of his day's work, consisting of several dozen rats, of both species, and put them away carefully for the night, their intended fate being to afford sport for his employer's dog next morning. What was his astonishment when he came to fetch them, to find none but brown rats remaining. These cannibals had devoured all their sable brethren."

The black rat (*Mus rattus*), sometimes called the old English rat, seems nevertheless to be not a truly indigenous rodent, but it is said by some to have come from

HEAD OF BLACK RAT.

the East,[4] probably from Persia, reaching Northern Europe by about the twelfth century.

Delisle and Poppe think that the black rat is a variety

THE BLACK RAT, *Mus rattus*. (AFTER BELL.)

[4] Some writers affirm that it came over to England with William the Conqueror. It still abounds in Normandy, and to this day it is known in Wales under the name of Llyodun Ffancon (the French mouse). By way of retaliation the French call the rat English.

of *M. alexandrinus*, that it came to Europe in ancient times on ships, and played its part in the Greek plague (the plague of Thucydides) and the Justinian plague.

It is usually stated that Albertus Magnus[5] was the first writer who mentioned the black rat as a German

THE BLACK RAT.

quadruped, but that proves very little when we remember that the rat was counted among mice. Hehn further points out that the name "rat" occurs much

[5] "Mus domesticus major, quem Rattum appellârim cum Alberto quoniam hoc nomine non Germani tantum, sed Itali etiam, Galli et Angli utuntur" (Gesner, "Icones Animalium quadrupedum viviparorum," &c., Zurich, 1553). (See text to illustration, p. 10.)

Ordo quartus.

LATINE Mus domeſticus maior, quem Rattum appellarim: quoniam hoc nomine non Germani tantũ, ſed Itali etiam, Galli & Angli utuntur. Hiſpani minorẽ Rat uocant, maiorem Ratón.

ITALICE Rato di caſa, Pantegana, Sourco.

GALLICE Rat.

GERMAN. Ratz.

THE RAT, FROM GESNER, *Icones Animalium*, 1553.

earlier in old High German glossaries and in the Anglo-Saxon of Ælfric. Finally, the animal representation on a Roman altar found in Rheims (made about 100 or 150 A.D.) is unquestionably a rat and not a mouse.

The brown rat (*Mus norvegicus*) is believed by some to have come from China, by others from India and Persia. It is mentioned for the first time by Conrad Gesner in his "Historia Animalium," which appeared in 1553. Gesner himself had not seen the brown rat, but described it from the reports he had received from eye-witnesses.

In 1727 several circumstances appear to have combined for bringing about the invasion by the rat of Europe. Pallas, who is the first to describe *Mus norvegicus* as a European quadruped, says that in that year a dreadful famine raged in India, and severe earthquakes visited Persia and the regions about the Caspian sea.[6] The brown rat, driven away from home, rushed towards the west, and crossed the Volga near Astrakhan in huge swarms.

In 1731 the brown rat was brought into England in ships coming from India,[7] and finding a foothold in the land of the "Mistress of the Sea," it proceeded on her ships on a triumphal journey round the world. In 1750 it commenced to overrun—with the port of Odessa as

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[6] Ælian probably thought of *Mus norvegicus* when he mentioned ("De Natura Animalium") that the "Caspian mouse" at times migrates in numberless swarms, and fearlessly swims across rivers, whilst holding on by its teeth to the tail of the "mouse" in front.

[7] See Map on p. 16.

its base[8]— Southern and Middle Russia, the Balkans, Austria, and Southern Prussia. By 1753 the rats had made their way from the northern parts of France to Paris, and about the end of the eighteenth century had reached such enormous numbers that several "public rat drives" were arranged. Bell mentions in one of his books ("British Quadrupeds") that when the French Government intended to remove from Paris the knacker's yard of Montfauçon! the project was fiercely opposed because the populace lived in terror lest the rats, deprived of their usual food, should attack them in their houses. He states that every day there would be thrown into this yard a number of dead horses, sometimes as many as thirty-five in one day. The next morning they would be found picked to the bone. "Dusaussois," continues Bell, "made a still more conclusive experiment. A part of his establishment was enclosed by solid walls, at the foot of which were made several holes for the ingress and egress of the rats. Into this enclosure he put the carcases of two or three horses. Towards the middle of the night, having first stopped up the holes, he got together several of his workmen. . . . Then commenced a general massacre. It was not necessary to take aim, for no matter how the blow was directed it was sure to hit a rat. Repeating this 'hunt' several times, they killed in the space of one month 16,000 rats."

---

[8] Goldsmith has been assured that the brown rat, though it was quite unknown in that country when it established itself in England, came to us from the coast of Ireland, whither it had been carried in the ships that traded in provisions to Gibraltar.

Towards 1800 the brown rat had overrun the whole of Germany, but does not seem to have arrived in Switzerland before 1809. Professor S. Nielsen states in his "Skandinaviska Fauna" (1820) that the brown rat had become a plague in Skaane (South of Sweden) by the year 1790. This is confirmed by Retzius ("Fauna suesica," 1800), who also mentions that thirty years before

RED FIELD VOLE, OR BANK VOLE, *Arvicola glareolus*.

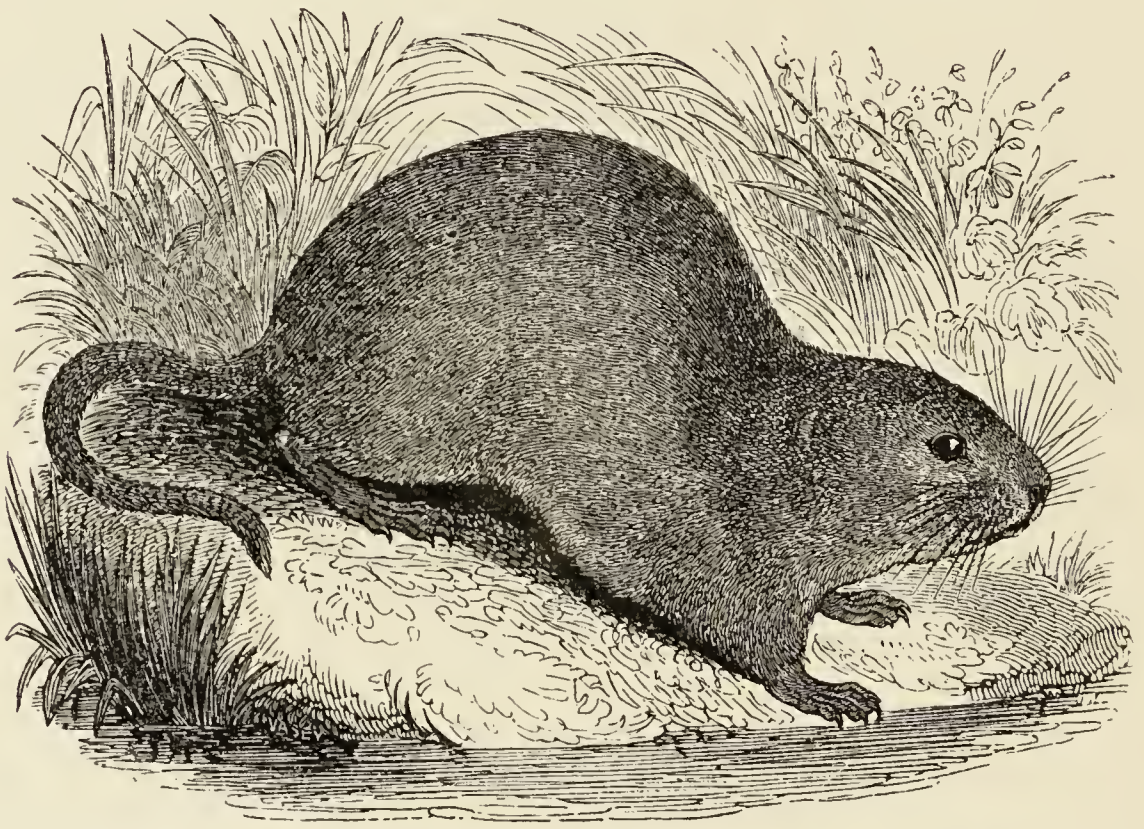
that (*i.e.*, in 1770) this rat was quite unknown in Sweden.

In the northern parts of Sweden and Finland, where the winters are long and severe, the rat is not found in the open air. It has, however, settled down in the buildings, and moves about with an unconcern which is incredible.[9] In Southern Sweden it is found everywhere,

[9] Zuschlag, "Le Rat migratoire et sa Destruction rationnelle," Copenhagen, 1903.

as also in Norway, where it infests even the northernmost coastland.

Denmark was invaded by the rat in 1790. It spread from Seeland and Fünen to Jutland, and thence to the Duchy of Schleswig-Holstein. By 1834 the black rat had been exterminated in Copenhagen, and the brown



THE WATER (RAT) VOLE, *Arvicola amphibicus.*

rat become supreme.[10] In Jutland, the Limfjord, a channel of considerable width, proved for a long time an obstacle to the rats' northward march. But Zuschlag states that two fishermen who had been eye-witnesses of the occurrence, related to him how the rats swam this

[10] During the preliminary campaign in Copenhagen in 1899, several "black" rats were caught, which on examination proved to be *Arvicola amphibicus*, the so-called water rat.

channel. During one night, in the autumn of 1847, these men were fishing in the Limfjord, when suddenly their boats were surrounded by immense swarms of rats, all making in a northerly direction, towards the Peninsula of Thy.[11] Not long afterwards the whole peninsula had been overrun by the brown rat, *Mus rattus* having been exterminated. These latter are to-day only found on a few small islands in the Limfjord, as, for instance, on Livoe.

On the Faroe Islands the brown rat is everywhere, and one may frequently see them swim *en masse* across the Straits that divide the islands of this archipelago.

North America was invaded in 1735 by rats that were brought in English ships. Till 1825 they had not extended very far beyond the coast, and even in 1870 they had only just reached Missouri ; but in 1900 they had spread over the whole of the United States and Canada, excepting alone those parts where snow and ice have barred their progress.

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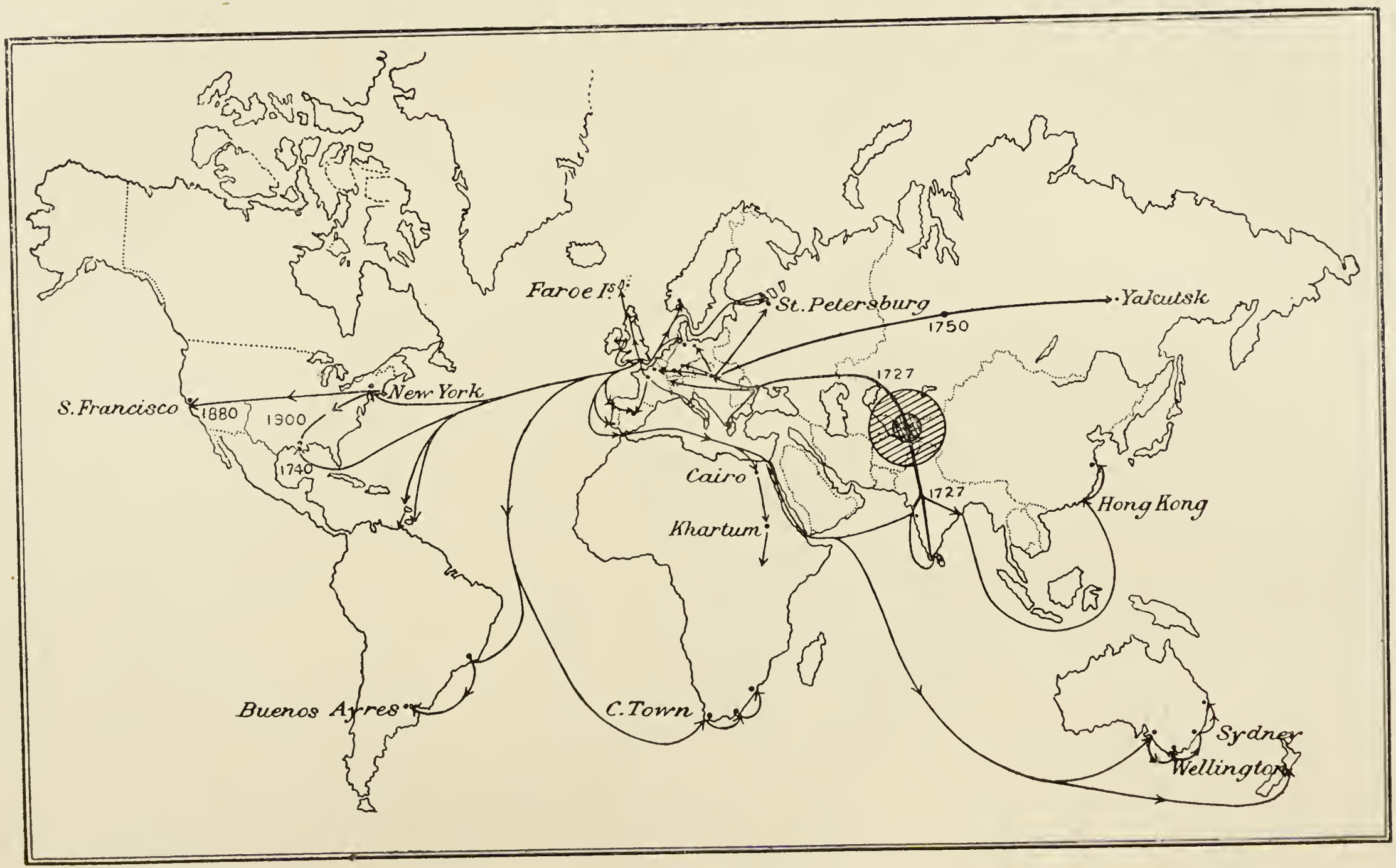
[11] Rats, impelled by scarcity of food, at times make emigrations in large bodies, generally during the night ; and on such journeys they will not hesitate to plunge boldly into and swim over such rivers as may come in their way. Some years ago the rats that frequented the London Zoological Gardens were in the habit of regularly swimming to and fro across the Regent's Canal (Lydekker, " Royal Natural History ").



MARCH OF THE RAT.

CHAPTER II.

On the Economic Loss Caused by Rats.

(1) There are at least as many rats as there are human beings.
(2) Each rat causes each day a loss, by the destruction of food and material, of at least one farthing.

For more than 3,000 years the rat has been regarded as a noxious animal by man, who waged war against it

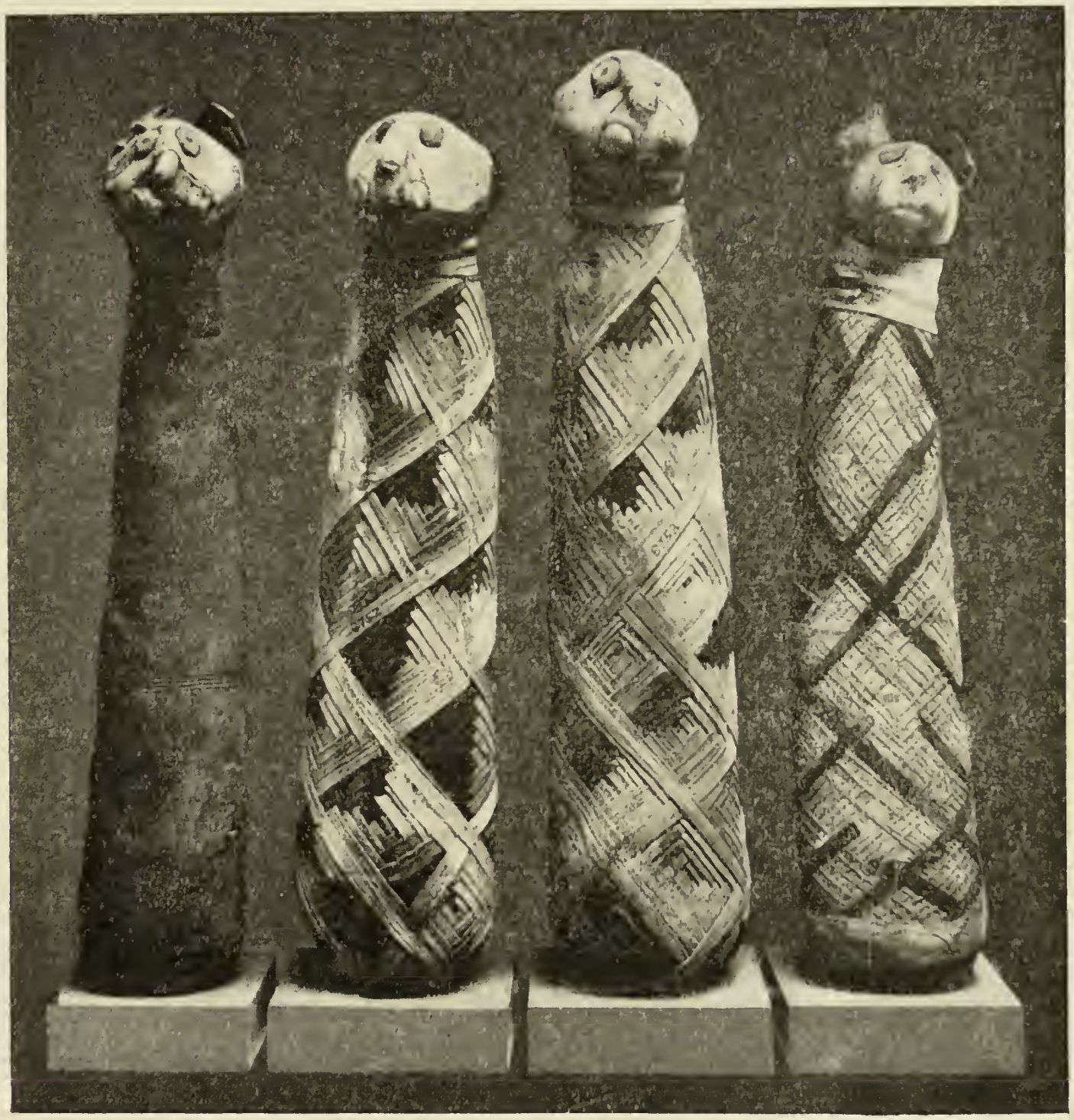
THE EGYPTIAN CAT.

in various ways. Thus we find that the Caffre or Egyptian cat, *F. caffra* (*caligata* or *maniculata*) was a domestic animal in Egypt twenty centuries B.C. That the taming

STATUE OF THE CAT-GODDESS BAST, WITH TWO STATUETTES OF CATS.

of a cat should have taken place in "the granary of the ancient world" is very natural. The cat protected their grain stores against rats and mice and was therefore held

in the highest reverence. Temples were erected in their honour, sacrifices and devotions were offered to them,[1]



MUMMIED AND BANDAGED CATS.

and it was customary for the members of the family in whose house a cat died to shave their eyebrows. Enor-

[1] They were fed on fish, kept for the purpose in tanks.

mous numbers of their bodies were embalmed and preserved in tombs and pits. He who killed a cat was regarded as a murderer and suffered the death penalty. Diodorus Siculus says: "Their lives and safeties were held more dearly than those of any other animal, whether biped or quadruped."

When Ptolemy was doing all he could to conciliate the Roman power, a Roman accidentally killed a cat, and the people rushed to his house; and neither the entreaties of the grandees, whom the king sent for the purpose, nor the terror of the Roman name, could protect him from punishment. "I do not relate this anecdote," adds Diodorus, "on the authority of another, for I was an eye-witness of it during my stay in Egypt."

That the ancient Egyptians had succeeded in training thoroughly the cats of which the embalmed bodies are found in such numbers at Bubastis and Beni-Hassan is perfectly well ascertained. This is, indeed, demonstrated by a painting in the British Museum representing a fowling scene.[2] Commenting upon this picture, Mr. P. H. Gosse observes that it appears to have been the custom for the fowler to enter upon such expeditions accompanied by some of the female members of his family. "Embarking on a boat with a few decoy-birds and a trained cat, they proceeded to such parts of the river as were fringed with dense masses of the tall papyrus-reed and swarming with waterfowl of various species. The cat, strange as it appears, was certainly

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[2] See p. 21.

taught to seize upon birds ; in the picture before us she has just caught one in her mouth, while she holds

MOSAIC PICTURE : FOWLING SCENE. THE CAT AS A RETRIEVER.

another with her two fore-paws, and a third between her hind-paws. It is probable also that the repugnance of this animal to wet her feet having been overcome by

training, she was accustomed to fetch such birds as fell into the water" (Lydekker, "Royal Natural History").

The mammal used by the ancient Greek for the purpose for which we employ the cat, and called by them *ailuros*,[3] was long considered to be the same as the modern cat. Professor Rolleston, however, showed that the ailuros of the Greek was really a marten, *Mustela foina*,

STONE MARTEN, *Martes foina*.

and this view receives some support from the fact that no remains of cats have been discovered among the ashes of Pompeii and Herculaneum. It is known that at the

---

Αἴλουρος, or *αἰέλουρος, ὁ, ἡ*, a cat, *Felis domesticus;* later, a weasel, from *αἰόλος* and *οὐρά*, as expressive of the wavy motion of the tail peculiar to the cat kind. Αἰόλος, quick moving, nimble, rapid ; *οὐρά*, tail.

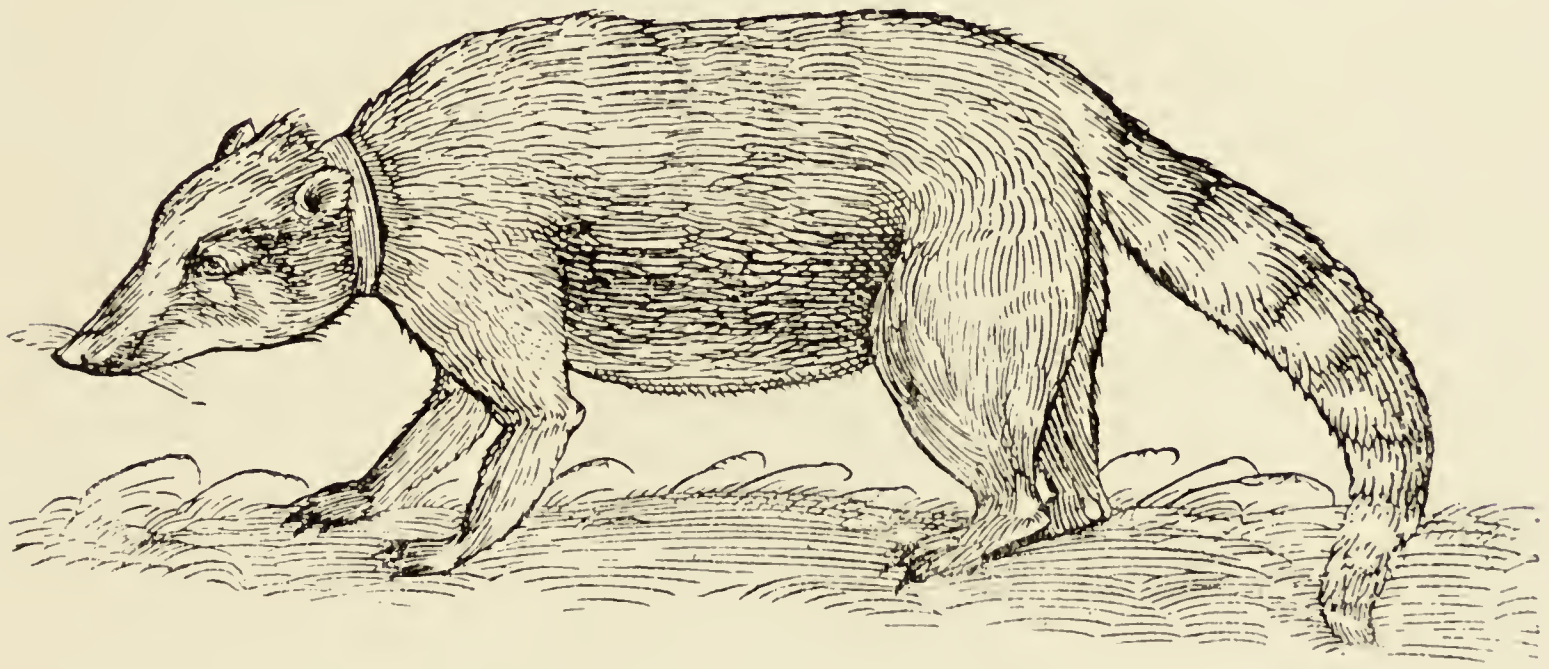
time of the plague they employed snakes in addition to their regular "mouse-killer."

In India the mongoose, and the ichneumon[4] in

LAT. Ichneumon, Enhydri ſpecies, id eſt Lutræ ſecundum quoſdam. Suillus apud recentiores quoſdam. Alijs Mus Indicus, uel Mus Pharaonis.

ITALICE Rato del'India. GAL. Rat d'India.

GERMAN. Indianiſche Muſ/oder Indianiſcher Otter.
Ichneumon ad uiuum expreſſus.



ICHNEUMON, GESNER, "Icones Animalium."

Egypt, have been greatly celebrated as destroyers of rats and mice. The latter was to the ancient Egyptians a

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[4] "The time-honoured name ichneumon, applied to the Egyptian representative of the group of civet-like animals, has of late years been very generally rejected by zoological writers in favour of the term mongoose, the native Indian name for the Oriental species" (Lydekker, "Royal Natural History").

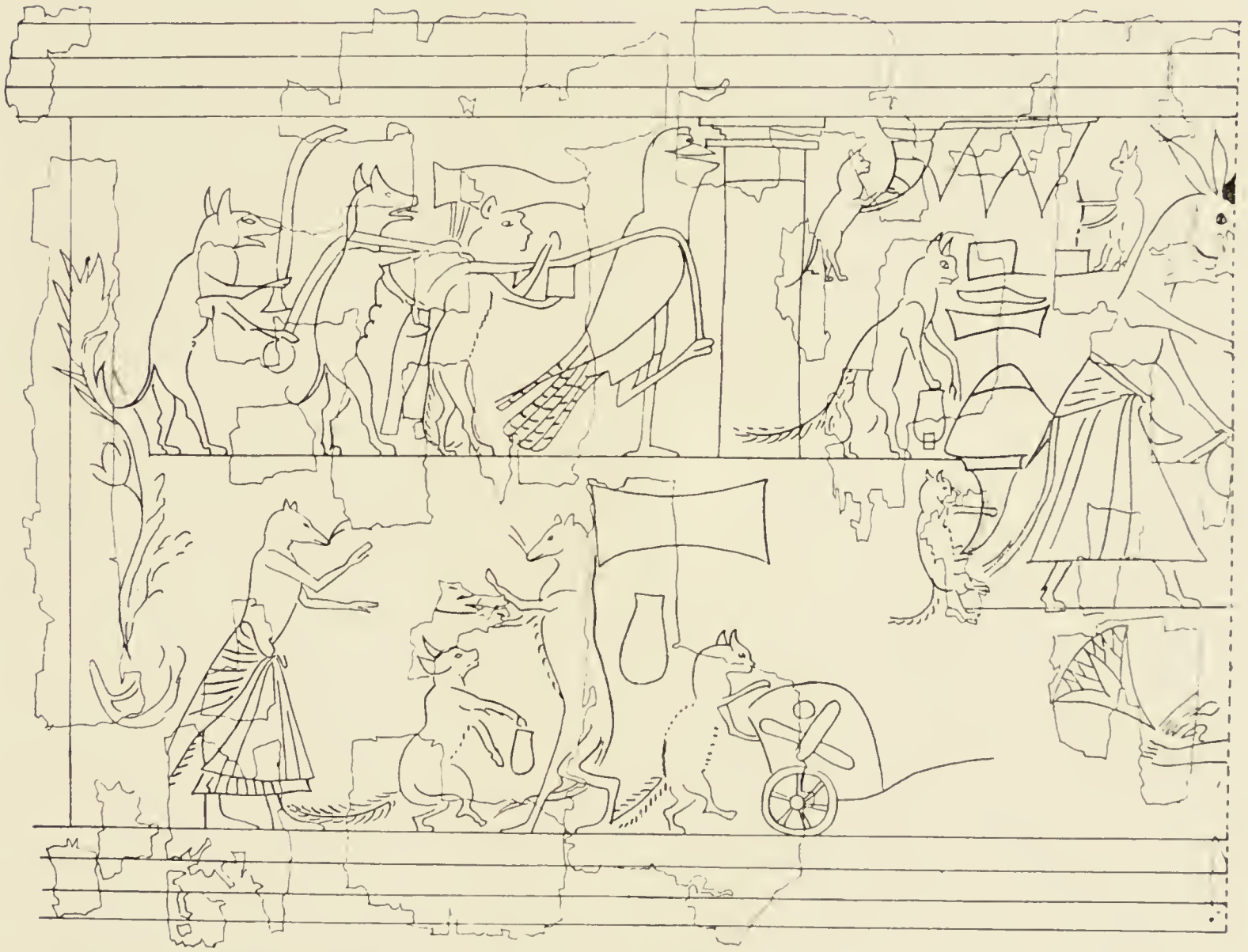
sacred animal, and is often depicted on their frescoes. It was, and is still, domesticated in Egypt.

That cats continued to be comparatively scarce and

STATUE OF AN ICHNEUMON.

valuable animals during the Middle Ages is proved by the laws made in several countries for their special protection, and the fines imposed on those who injured or killed them.

The thrifty Welsh husbandmen were among those who many centuries ago recognized the value of the cat as a defender of the grain stores. In the reign of Howell (Hywel) the Good, who died in 938 A.D., a law was



THE BATTLE BETWEEN THE CATS AND THE RATS. A SATIRICAL PAPYRUS.

passed fixing the price of cats according to their ages and qualities, beginning with a price for a kitten before it could see, and enacting that "if anyone stole or killed the cat that guarded the prince's granary he was to forfeit a milch ewe, its fleece and lamb; or as much

wheat as when poured on the body, suspended by the tail, the head touching the floor, would form a heap high enough to cover the tip of the tail."

In 1284, Hameln, a town in Hanover situated on the River Weser, had, according to the old legend, become so much infested by rats that a piper (or rat-catcher) was engaged to free the town from the rat plague through the mystic charms of his pipe. But when the people refused to pay him the promised reward, he exercised the power of his music upon the children of Hameln, and drew them away into the heart of an adjoining hill, which opened to receive them.

This legend has grown out of an entry in the Archives of the Church of St. Boniface, which said that in the year 1284, "in die Johannis et Pauli perdiderunt Hamelenses centum et triginta pueros qui intraverunt montem Calvariam. Omnes eos vivos Calvaria sorpsit." Four hundred years afterwards Samuel Ehrich, "a servant of God" and Rector of Wallensen, near Hameln, says in "Exodus Hamelensis" (written to prove the story of the Pied Piper): "There is a place called Calvaria, or Koppenberg (Skull Mount). This place was filled with the heads or skulls of those who had been executed. For it was the custom to decapitate here all evildoers. And this Calvaria or Koppenberg is situated an arrows flight from Hameln, where is held the Criminal Court on the highway which leadeth to Hanover, and between Justitia and the locus funestis, where it is related of the children that they entered is a hollow thiswise that the Court is on the left hand, but the Calvary on the right

hand. Therefore, properly there is no mount but only a small hill, and in it a hollow as if it was a small fall of earth."

Similar stories are told of other places. A man with a violin came once to Brandenburg. All the children followed him; he led them to the Marienberg, which opened and admitted him and the little ones, and closing upon them left none behind. At Lorch, near Worms, a hermit delivered the town of a plague of flies, and being cheated out of his promised reward, piped all the pigs into the lake and vanished with them. The next year a charcoal-burner freed the town of a plague of crickets, and being again refused his reward, piped all the sheep into the lake. The third year came a plague of rats. A little old man of the mountain offered to free the land for a thousand gulden. Having done so and being again cheated, the little man piped all the children away.

The first practical attempt at destroying rats in the public interest, in order to minimize the damage done by them to private and public property, seems to have been made in England. About the year 1740 ordinances were made by numerous parishes directing the church-wardens to pay one penny—in some cases two pence—for every dead rat brought to them. But soon the hopelessness of the task becomes apparent, and the ordinances fall into disuse.

Towards the middle of the eighteenth century an English colony, realizing that anything short of concerted action must fail against the enormous fecundity of the brown rat, endeavoured to deal with the rat problem

by means of a law. The original Act of 1745 does not appear to have been preserved either at the Colonial Office or at the British Museum, but there is a record of an Act passed in 1748 which contains the Law of 1745. This Act, the text of which is given in the Appendix,[5] was repealed by 17 Victoria, cap. 12, An Act to repeal the Acts of this Island for destroying Wild Monkeys, Raccoons and Rats, November 10, 1853. As justification for the repeal the Act simply states: "Whereas it is deemed expedient to relieve the inhabitants of such charges for the future."[6] Quite recently (July, 1908), a third Rat Act was passed, the text of which will be found in the Appendix.[7]

In 1880, 135 years after the passing of the first Rat Law of Barbados, another English colony, Antigua, enacted a law "to encourage the destruction of rats in this Island."[8]

I have been unable to find out whether this Act fulfilled the hopes which lead to its being passed. All that is on record concerning it is that it is cited among the expired laws in Act 9, Antigua 1892: "An act to provide for the revision of the Law of the Presidency of Antigua."

Both the Acts recognize only the economic side of the rat problem. They aim at preventing the needless

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[5] Page 152.

[6] A premium of 5s. was paid for each wild monkey and raccoon handed in dead.

[7] Page 158.

[8] For the text see Appendix, p. 153.

destruction of good food and material. In the Rat Ordinance of Hong Kong[9] we reach a higher level. Epidemiology has been warning the world that it must look to the rat as the chief factor in the spread of the bubonic plague. The economic side is here, therefore, entirely disregarded, and the sole object of the Ordinance is to effect the destruction of rats in order to minimize the danger arising from their presence of the spread of the plague.

This Ordinance was passed on February 27, 1902, and was embodied in the following year in the Hong Kong Public Health and Building Ordinance,[10] which is one of the most statesmanlike measures on the subject passed by any legislative body. I have been informed by various correspondents in Hong Kong that the results of the measures taken under this Ordinance have had the most beneficial results.

The Agitation in Denmark.

A new era in the fight of man against the rat commenced with Zuschlag, of Copenhagen. By profession a civil engineer, by choice an ardent student of economic zoology, he was the first man to realize, in the pursuit of his studies, the full extent of the danger threatening mankind from the presence of innumerable rats. "He pointed out to his countrymen the awful waste of wealth

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[9] Ordinances of Hong Kong, 1902 : No. 1. An Ordinance to authorize the making of regulations with regard to rats. For text, see Appendix, p. 155.

[10] Ordinances of Hong Kong, 1903 : Public Health and Buildings Act, cap. 16, sec. 35, f and g.

caused by permitting the rats to destroy, unhindered, vast quantities of food and material; nor did he cease to

EMIL ZUSCHLAG,
ADMINISTRATOR-IN-CHIEF OF THE DANISH RAT LAW.

impress upon the Danish people the fact that the rat is the principal agent in the dissemination of both plague

and trichinosis. He succeeded in forming a Society which soon had a membership of over 2,000 men of standing and known influence, and was supported by every health committee, every scientific society, every bank, and every shipping firm and insurance company in Denmark."

ZUSCHLAG AS ROBESPIERRE.
A CARICATURE FROM THE DANISH RAT WAR.

"He induced several towns to make, under his supervision, preliminary experiments in rat destruction on a large scale, and having conducted these tests successfully, and thus supplied an invaluable object-lesson, he published his book 'The Rat and Civilization' (re-issued

afterwards in French under the title of 'Le Rat Migratoire et sa Destruction Rationnelle'), which not only brought about the passing of the Danish Rat Law but was also the cause of the movement which will sooner or later end in an international war against the rat." [11]

Zuschlag, though more immediately concerned with obtaining the passage of a rat law for his country, never failed to urge the necessity for taking international measures, if the rat problem was to be dealt with seriously. He therefore formed a second society, called L'Association Internationale pour la Destruction Rationnelle des Rats, in which every country in Europe excepting Great Britain is either officially or influentially represented. Unity of action has, however, recently been provided for by the Incorporated Society for the Destruction of Vermin[12] electing Zuschlag a Vice-President and formally adopting the Danish policy as embodied in the Danish Rat Law of 1908.

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[11] Quoted from my article in the *Daily Mail*, October 9, 1907, "A World's War against the Rat."

[12] A good deal of criticism has been published concerning the name of the Society and the choice of the word "vermin." As to the "size" of the title, the Society is now definitely burdened with it. As to the word "vermin," all the authorities are clearly on the side of the Society and against the critics. They all define VERMIN (*vermayne*, French *vermine*, as if from a Latin *verminus* (from *vermes*, worm) as :—

(1) Any wild or noxious animal ; a reptile : "The crocodile is a mischievous four-footed beast, a dangerous vermin used to both elements" (P. Holland, "Ammianus Marcellinus," p. 212).

(2) A name applied generally to certain mischievous or offensive animals, as (*a*) to the smaller mammals, and certain kinds of birds

THE DANISH RAT WAR: "SCENES FROM THE BATTLEFIELD."

zoologists and epidemiologists, Zuschlag made the following observations: "The concluding part of the 1903-

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which damage man's crops, or other belongings, as otters, foxes, polecats, weasels, rats, mice, moles, kites; (*b*) to noxious, offensive or destructive insects or the like, as grubs, flies, lice, fleas.

(3) Applied to low, noxious, despicable human beings in contempt. "They had been regarded by the human population as hateful vermin who ought to be exterminated without mercy" (Macaulay).

Ainsworth uses the term "verminer" when speaking of dogs: "The beagles, the lurchers, and lastly the verminers, or as we should call them, the terriers."

The German word for vermin, "*Ungeziefer*," means an animal which was unclean and therefore unsuitable for being offered up to the gods.

1906 supplement of my book 'Le Rat Migratoire et sa Destruction Rationnelle') shows that the Danish Minister of the Interior promised in the name of the Cabinet, during the proceedings of the Session 1905-1906, to bring in a Bill which in his opinion would be likely to pass, because it would be based upon the previous Government and private Bills, and would further contain certain essential regulations absent from former measures. Accordingly a Bill dealing with this subject was drafted in the Ministry during the summer and introduced by the Minister of the Interior at the beginning of the Session 1906-1907. It was treated as a non-contentious Bill, and after the first reading referred to a Committee of eleven, which decided unanimously to recommend the acceptance of the Bill, with the amendment that the grant made by the State for the purchase of preparations for the extermination of rats should be increased by 33 per cent., and the minimum contribution to be made by the local authorities towards the payment of premiums by 50 per cent. On the other points of this Government measure existed an absolute agreement."

"On coming back to the Folkething the Bill passed the second and third readings unanimously, and went to the Landsthing where it passed the three readings equally unanimously. By Royal Proclamation of March 22, 1907, the Bill became Law, and by the Circular of the Minister of the Interior, dated May 1, 1907, came into operation on July 1, 1907. The 'Danish Association for the Extermination of Rats' was charged by the Minister of the Interior with the supervision of the

"SENTENCED TO DEATH": ZUSCHLAG-ROBESPIERRE READING TO THE RATS THE PROMULGATION OF THE DANISH RAT LAW.

collecting of the rats. As the Act is here reprinted[13] no word of explanation will be necessary. It should, however, be borne in mind that the Act is essentially in the nature of an experimental law, and is to come up for revision after it has been in force three years.

"It must not be forgotten that the original measure of 1907 does not suggest what should be the maximum contribution to be made by the State and the local authorities towards the purpose of the Bill. Though the assumption is that, as the rats are injurious animals, the cost of their extermination is more than compensated by the resulting corresponding decrease in damage, no definite agreement could be arrived at on this point. Further, as it was impossible (owing to the fact that the number of rats could not even approximately be ascertained) to calculate the amount of money which the State might be called upon to pay in the way of premiums, both the Finance Minister and the Finance Committee withheld their consent until such time as the Bill should contain a clause fixing the Government grant at a certain definite amount.

"The Law of March 22, 1907, defines the maximum contribution to be made by the State during the first three years, and determines also the duty of the local authorities to bear all the expenditure incurred under this Act with the district of each local authority and in proportion to the infestation of rats present.

"The immediate practical results of this experimental Law will be to learn the extent of infestation by rats

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[13] Appendix, p. 156.

"THE CHARGE OF THE CAT BRIGADE":
ZUSCHLAG LEADING THE DANISH PARLIAMENT.

prevailing in the country, and, at the same time, to effect a considerable reduction in the number of rats during the three years in which the Act is in force.

"The Association for the Extermination of Rats has been officially recognized by the State, through the Minister of the Interior, and is charged with the duty of gathering statistics concerning the progress of collection of rats, and of advising the local authorities as to the most practical methods to be adopted in carrying out the Act. On the basis of such statistics it will be possible for the Legislature, when the Act comes up for revision, to fix a certain definite expenditure on this head, so that should the cost incurred under this Act be in future equally distributed between the State and the local authorities, a certain sum would have to be voted every year in the Budget, decreasing, of course, in amount in proportion as the number of rats would be decreasing. It will be understood that, even after the rats have been practically exterminated, there will always be incurred a small administrative expenditure in connection with the prevention of the re-infestation of the country by rats through their being brought to this country by ships or coming over the border. The fecundity of rats is known to be so enormous that, unless such preventive measures are of permanent character, the progeny of the few rats that might be expected to have escaped destruction, reinforced by that of rats imported on ship-board or having come over the border, would soon rise to such a number as to constitute a new plague. It will therefore be necessary to keep up permanently the system of paying

premiums, and thus keep the number of rats at that minimum where they may be said to have lost their power of doing harm."

TWO MUMMIED AND BANDAGED HAWKS.

The quarterly reports which Zuschlag has been good enough to send me reveal a success which even the most

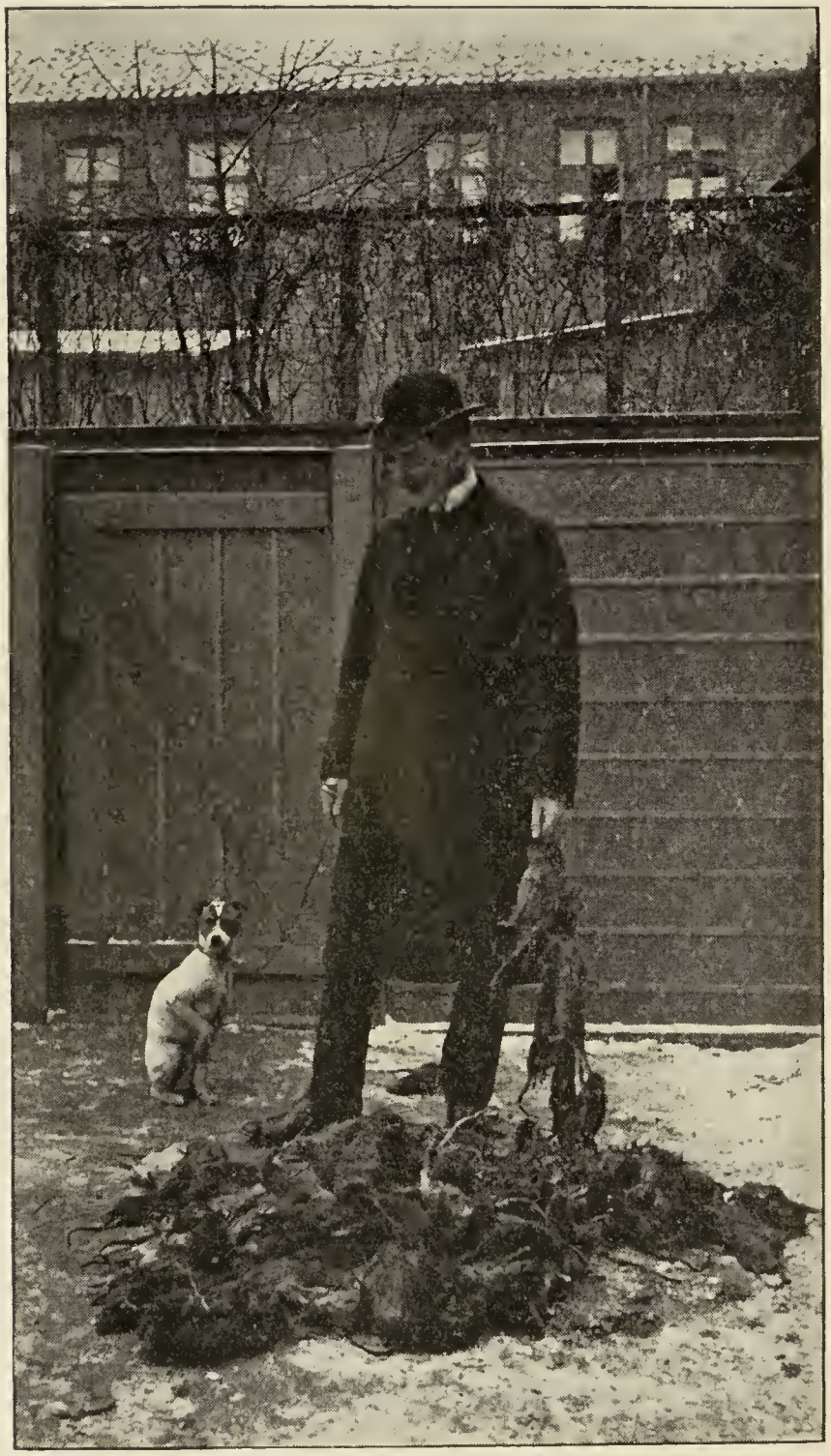
sanguine supporter of the premium system had not dared to expect. The interest in the rat crusade seems to have grown from quarter to quarter, as evidenced by the increasing number of rats reported killed. During the first twelve months premiums have been paid on over one million rats, and it is deserving of special note that not a single case has come to light of an offence against the provisions of this law. A Danish police officer with whom I discussed this point said that he should be greatly surprised to hear of a man foolish enough to offend against the Rat Law. "In the first place," he said, "our people are so keen in this matter that they are their own detectives. A man attempting to defraud the common weal under this Act would be found out in twenty-four hours. Furthermore, what possible motive could you suggest? It cannot be gain, that much is certain. You must remember that the premium per rat-tail has been fixed at about one penny in English money, and in some parts of the country at a halfpenny. Now, to breed and preserve rats in order to obtain that penny or half-penny would cost, in rat-proof cages, food and labour, a sum that would work out at not less than threepence per rat. To import them from abroad would seem equally absurd. We do not know of any country where they could be bought cheap except England, because of your Rat and Sparrow Clubs. It is just possible that some of our people might make arrangements with some members of your Rat and Sparrow Clubs for a supply of dead rats after they had been 'booked in' at the club. But think what such a

transaction would entail; the 'exporters' would have to store, for some time at any rate, say a month, a

ANOTHER STATUE OF A HAWK.

number of dead rats—for tails alone do not count with us, it is the whole rat or nothing—they would have to

forward this shipment of dead rats, declare them as something or other, pay the freight from England,



"ENGLISH JACK" AND HIS VICTIMS.

smuggle this cargo of dead rats from the ship to the shore, and from there to the depôt. No, if it could be

done successfully the game would not be worth the candle, for it would mean, at the best, paying a guinea to earn a pound, not to mention a possible 'three month's hard.' I know that in Japan some time back some people made a good thing out of the premiums by handing in rat-skins that had been imported from China, but, as I told you, we want the whole rat, and therein lies our safe-guard, as it will be yours, if the English are going to have a rat law. Let those that see 'gigantic frauds' try the experiment of breeding rats for profit—at one penny per head—or keep a few dead rats about the place. They will know better very soon."

We see[14] that the Danish Rat Law provides for a kind of partnership between the State, the municipalities, and Zuschlag, as the President of the Danish Society for the Extermination of Rats. The Legislature said in effect to Zuschlag: If you and your powerful Society are so confident that the Rat Law, for which you are agitating, is going to confer such great benefits on this country we will pass it, on the condition that you will undertake to administer it, and that your Society will provide towards the administration expenses, say, 10,000 kroner a year for three years. If you will do that, we will make a law compelling the municipalities to provide a fund out of which to pay for the premiums on all the rats handed in within their areas of jurisdiction, by a levy of, say, 3 kroner per each 100 inhabitants per year—and to make arrangements for the reception and

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[14] Appendix, p. 156.

proper disposal of the dead rats. Finally, we shall make the State spend 30,000 kroner a year for three years, one-third on experiments with scientific remedies, and the other two-thirds on applying such preparations on State properties, or supplying them free of charge to those who are too poor to provide a means of rat destruction.

THE DANISH RAT WAR.
CHILDREN EXCHANGING RATS FOR COINS OF THE REALM.

This combination of the power of the State, the organization of the local authorities, an advanced public spirit, and the enthusiasm aud expert knowledge of the intellectual father of the Rat Law has produced the most satisfactory results at a minimum of inconvenience and expense.

In the towns the dead rats are received at collecting depôts, which have been instituted at the fire brigade stations, whilst the rural districts are served by "travelling depôts." Each depôt is supplied with air-tight receptacles made of galvanized iron (for the bodies of the rats), an air-tight box (for the tails), and an apparatus for cutting off the tails. As each rat is handed in the

A COLLECTING VAN OF THE DANISH SOCIETY FOR THE EXTERMINATION OF RATS.

premium is paid, the tail cut off, and the tail and body thrown into the different receptacles. In the evening an official calls to check the number of tails with the cash expended, and to refund the amount paid out. The bodies and tails are then taken to the local gasworks and burnt. In the rural district they are buried under

the supervision of the sanitary authorities.[15] Daily, weekly, and monthly reports must be filled in by local authorities and forwarded to Zuschlag's Society for the

THE DANISH RAT WAR. "READY TO START."

Extermination of Rats. This Society is always ready to give advice on every matter pertaining to the administration and carrying out of the Rat Law, and supplies the

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[15] Ardent reformers have pointed out from time to time that the rat problem would solve itself if ways could be discovered of utilizing rats or their skins commercially, and the English Incorporated Society for the Destruction of Vermin has sought to stimulate the destruction of rats by offering a prize of ten guineas (so far unearned) for the best

suggestion of that kind. The Danish Government has, however, decided to do without the revenue to be derived from this source, the Law ordering, as we have seen, that all the rats handed in must be burnt or buried, body and tail.—It is interesting to note in this connection that the eminently practical Danish people have only in legends been able to utilize rat and mouse skins. In the legend of "The Girl in the Mouse-skin Dress" we are told that a nobleman, who had an only daughter, afraid that harm might befall her during the war, had a strong-room built for her in a mountain, and laid in a stock of provisions enough to last seven years. "If, at the end of that time, he did not come for her she might conclude that he was dead, and might then leave the mount. Her little dog was the only companion she was to have. . . . The young damsel, after a year or two had passed, found that her stock of food was nearly exhausted, but that there was a tremendous number of mice. Her little dog killed a great many every day. These she skinned, roasted and ate, and gave the bones to her little dog; but she stitched all the skins together and made herself a cloak or garment, which was so large that she could quite wrap herself up in it." Then she dug her way out of the mount, and after some adventures married the customary prince. (Molbech, "Udvalgte Eventyr," Copenhagen, 1843).

Various reformers have suggested that rats should be used as articles of food. In support of this idea it is usually stated that these creatures are thus used in China, being split in halves, and cooked as tidbits for the delicate. The scavengers of Paris consider that a fricasseed rat makes an excellent relish; and during the siege of that city a ragout of rats fetched a good round sum. There is no consistency, as Dr. Wynter Blyth thinks, in eating rabbits, and refusing rats, in enjoying a reptile like the turtle, but shuddering at frogs.

"The fat [as Robert Lovell bore witness, 1661] helpeth the palsy; so doth that of the dormouse." It is said that the grey matter of the brown rat's brain is highly developed, which accounts for the high order of its natural cunning as "the knowingest varmint of any we have."

Recently an eminent Chinese authority has strongly advocated the use of rats as food for preserving or restoring the hair. He writes thus on the subject: "What the carrot is to a horse's coat the rat is to the human hair. Every horseman knows that a regimen of carrots will make his stud as smooth and lustrous as velvet; and the Chinese, especially the women, know that rats used as food stop the falling out of hair, and make the locks soft, silky, and beautiful."

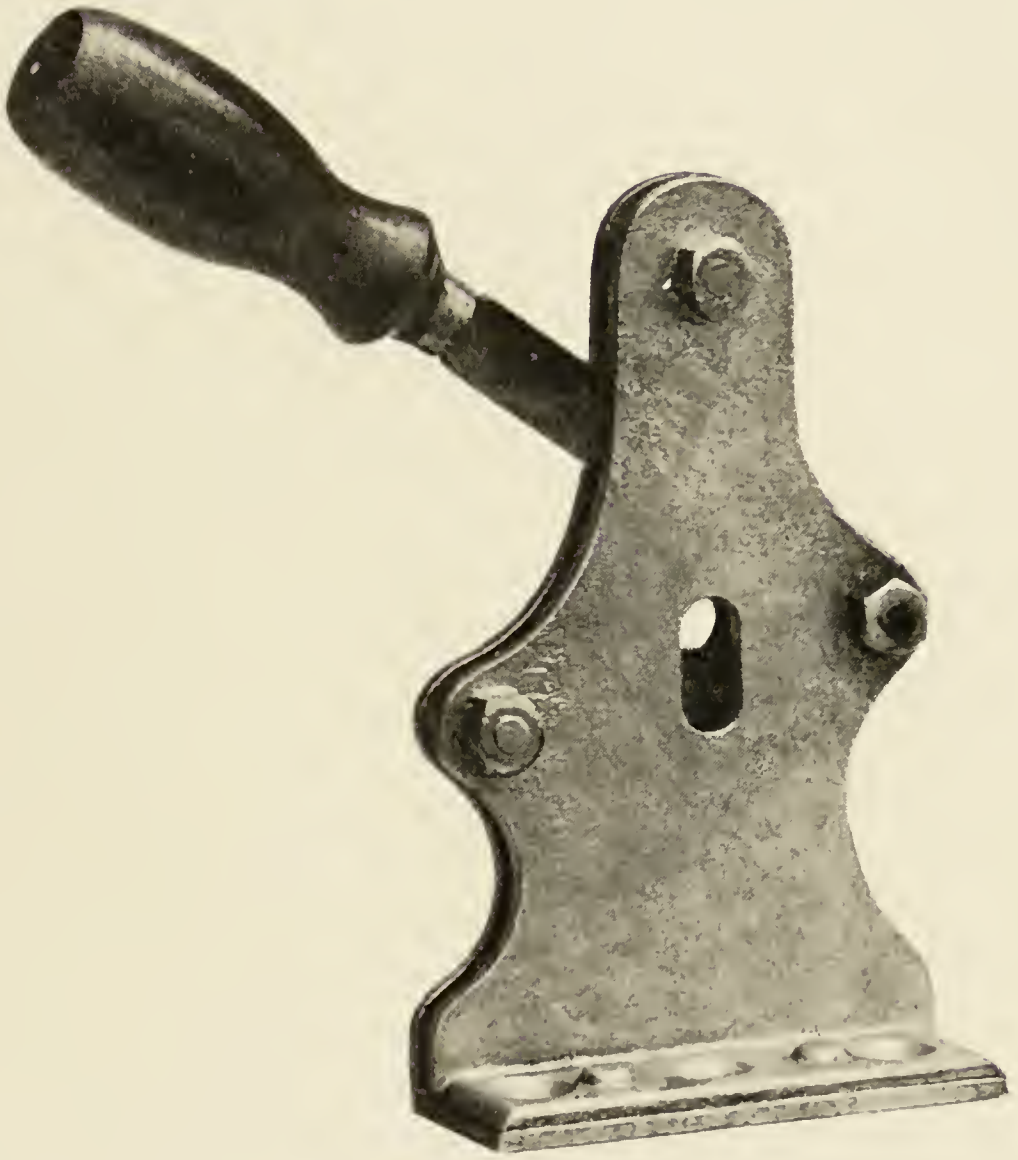
receptacles, boxes, apparatus and the various schedules at cost price. As administrator of the Act, Zuschlag must submit at the end of each working year a state-

THE DANISH RAT WAR. "THE WARRIORS' RETURN."

ment to the Danish Home Office showing the income and expenditure, together with statistics, and other information obtained in the course of the working of the Act.

The Crusade in England.

Whilst Zuschlag in Denmark did not fail to make public every remarkable instance of damage done by rats



APPARATUS USED IN THE DANISH COLLECTING DEPÔTS FOR CUTTING OFF RAT-TAILS

he did not commit himself to a statement either concerning the probable number of rats present in his country or the probable damage done by them. The tragedy of the Swedish farmer who had been eaten up alive by rats,[16]

[16] The late Mr. R. Stephenson, M.P., relates an English parallel to

the destruction of bird-life on the island of Degat,[17] and of dozens of similar cases, together with the advanced public spirit of his countrymen and their horror of waste

this affair : " In the Walker Colliery, near Killingworth, in which many horses were employed, the rats had accumulated in great multitudes. It was customary at holiday times to bring to the surface the horses and the fodder, and to close the pit for a time. On one occasion, when the holiday had extended to ten days or a fortnight, during which the rats had been deprived of food, on re-opening the pit the first man who descended was attacked by the starving rats, and speedily killed and devoured."

There must have been an extraordinary plague of rats in Germany about Bishop Hatto's time, from the tenth to the twelfth century (as the vermin are indifferently described as mice and rats, the black rat, which is some two inches smaller than the brown rat, is evidently meant). Bishop Hatto was a hard-hearted man who opened his hand only for blessing but not for giving. In 920 there was a great famine in Germany, and, wearied of the continued cries for food, it is related that he invited the people into a great barn. Then, when he saw that it could hold no more, Bishop Hatto made fast the door and set fire to the barn and burned all the people in it. " But the rats are chosen to revenge this horrible deed. First they eat the picture of the Bishop out of the frame, by way of a preliminary warning, then devour all his corn, and finally invade the palace. Full of terror, the prelate flies to the mouse-tower, but the rats follow him there across the water, and devour him alive." The foundation of this legend, woven around a bishop who, according to all account, was rather a good man, is the name of " mouse-tower." It was originally erected as a station for collecting tolls on the vessels which passed up and down the river. "Mausen" means : to con, to spy, taken from the action of the cat who keeps a patient look-out for mice. Popular wish gave this conning tower the name of " Mäuse-turm," and the imagination of the legend-maker did the rest.

In " Don Quixote " we read that the rats ate the wicked Don Rodric, who was instrumental in bringing the Moors into Spain. The same story is told of Bishop Widerolf, of Strassburg (997), and of Bishop Adolf, of Cologne, who died in 1112. Among the laymen who are thus executed by rats (or mice) because of some crime against the poor is the Swiss Baron of Güttingen, whose castle stood in Lake Constance ; an Austrian nobleman, who died in the Mouse-tower of Holzöstler ;

BISHOP HATTO AND THE MICE.

of any kind made it unnecessary for him to tackle the difficult subject of formulating estimates that would bear criticism. But here in England the case was different. Here there was not only an appalling indifference concerning the extent of the damage done by rats, but there

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a Bavarian count, who was devoured in his stronghold in the Wörthsee, also called Mouse Lake ; and the owner of the Mäuseschloss in the Hirschberger Lake.—Magolus relates the sad end of King Poppiel II. of Poland. "When the Poles murmured at the bad government of the King he summoned the chief grumblers to his palace and then poisoned them. After this the corpses were flung by his orders into the Lake Gopolo. Then the king held a banquet of rejoicing at having freed himself from these troublesome complainers ; but during the feast, by a strange metamorphosis (*mira quadam metamorphosi*), a huge swarm of rats, engendered by the decomposition of the corpses, rushed into the palace, invaded the banqueting hall, and in the presence of the whole court devoured King Poppiel, his wife and children, alive." (The idea of the spontaneous generation of vermin out of putrefying matter is a favourite one with the maker of legends.)

A Scandinavian legend relates that King Knut the Saint was murdered by the Earl Asbjorn in 1086. The following year the country suffered severely from famine, and Asbjorn was fallen upon by rats and eaten up.

[17] "In 1905 a boy whose parents lived on the Island Degat, not far from the Danish mainland, bought from a travelling "show" a pair of tame white rats with yellow spots. Somehow the rats managed to escape, and this is the result : while two years ago the rat was not known on Degat, the island to-day is swarming with white and yellow rats ; and whilst Degat was formerly famous for its wealth of birds, bird-life is now extinct" (Zuschlag, December, 1907). Lydekker says on this subject : "When the animals obtain access to small islands inhabited by sea-birds or rabbits, the abundant food soon leads to a prodigious increase in their numbers ; but sooner or later they practically exterminate the indigenous inhabitants, and then have to seek a more precarious

did not even exist an agreement as to whether rats were or were not noxious animals. While the text-books counted the rats among the injurious animals, the man in the street fondly believed that the rats formed a kind of unpaid staff of municipal scavengers and interceptors, thus doing much good work and incidentally relieving his rates. In the country the rat was regarded as a

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livelihood by preying upon the crustaceans and molluscs on the shore."

Bell mentions one instance related by the late Mr. Stephenson, M.P. : "In the year 1816 or 1817 a Prussian vessel was wrecked on the S.W. side of Puffin Island, on the coast of Wales. The island takes its name from the multitudes of puffins which frequented it, and it was also colonized by vast numbers of rabbits. No annoyance from rats had ever been experienced until the occurrence above mentioned took place, but after that, in consequence of the immigration of these animals from the wreck to the shore and their subsequent rapid increase, the rabbits were almost, if not wholly, exterminated ; the puffins were ejected by the destruction of their eggs by the rats ; and the parties who rented gave up their holdings."

("Puffin" is the common English name of a seabird, *Fratercula arctica*, also known in various parts of the British coast as the Bottlenose, Coulterney, Pope, Sea-Parrot and Tam Nore, to say nothing of the still more local designations. In old times puffins were a valuable commodity to the owners of their breeding-places, for the young were taken from the holes in which they were hatched, and being "exceeding fat," as Carew wrote in 1602 ("Survey of Cornwall"), were "kept salted and reputed for fish, as coming nearest thereto in taste." In 1345, according to a document from which an extract is given in Heath's "Island of Scilly," these islands were held of the Crown at a yearly rent of 300 puffins, or 6s. 8d., being one-sixth of their estimated value. Newton ("Dictionary of Birds," London, 1894) estimated the number of puffins which had their home in one locality among the Hebrides at 3,000,000.) Goldsmith relates a similar case with regard to frogs : "They had been introduced into Ireland some considerable time before the brown rat, and had multiplied abundantly ; but when the rat arrived they were pursued in their marshes by these indefatigable hunters, and eaten clean off the Emerald Isle." "It is said that the common Norway rat, in the short

necessary evil, which, like a severe frost or "blight," must be endured, because there was no choice in the matter. Many a farmer and even estate agent have told me, with a supreme disregard of the historical fact, that "there always were rats in England, and always will be. They are here for some good purpose, you may be sure, else they wouldn't be here." This good purpose seemed

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space of two years, annihilated in this northern end of the island the small New Zealand species" (Darwin, "A Naturalist's Voyage round the World," London, 1890).

Another case is recorded by Captain Nesbitt, one of the Elder Brethren of Trinity House: "In 1895, when Trinity House bought up all the private light-houses round the coast, the Skerries, near Holyhead, had immense numbers of rabbits which were extensively used by the lighthouse keepers. A few years ago (1860) an American vessel was wrecked there, on board of which were a number of rats. They swam to shore. They have now (1874) increased prodigiously in numbers, have destroyed the wild rabbits, and are obliged to live to a great degree on the shell-fish on the shore. The lighthouse men have not only lost the wild rabbits, but find a difficulty in rearing any tame ones, because of the attack of the rats."

The following fact, related by Professor Ehlers, one of the best known Danish physicians, proves not only that rats will readily attack human beings, but also that they are immune to leprosy. He states that when he was visiting the Lepers' Hospital at Gocerito, Trinidad, he noticed that all the leper patients were without toes, and this even in those cases where leprosy had not yet extended to either feet or hands. Expressing his astonishment at this remarkable state of affairs, he was told by Dr. Knapp, the resident medical officer, that these mutilations had been made by the rats. He explained that the rats seemed to know that the patients were too weak to defend themselves against these attacks, and as the island was swarming with them, nothing short of extermination would save the patients from being fed upon by the rat whenever these animals felt inclined for a meal of lepers' toes. He added that the rats, as far as could be ascertained, seemed none the worse for eating leprous flesh, for they would come to the hospital nearly every night.

to be with some the excellent sport which the rat provided, with others the "valuable work done by them as scavengers."

Zuschlag agreed, therefore, with me that if we would hope to make these various attitudes of mind see the necessity of waging relentless war against the rat, not only in England but throughout the whole of the British Empire, we should have to "go into figures." Though I could never hope, in the nature of the problem, to form an estimate that would possess the accuracy of a census, it nevertheless seemed to me that I might be able to put forward such minimum figures as might be regarded as reasonable, and provide us with a good "working" estimate.

I began, therefore, by making enquiries among numerous landowners, estate agents, and farmers as to whether they thought it would be reasonable to assume that "there is at least one rat to each acre of cultivated land."[18] The replies were almost invariably, "Certainly," or, "Absurdly low." As regards the villages, towns and cities, I considered it unnecessary to ask a question, the

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[18] There are forty million acres of cultivated land in the United Kingdom.—Mr. Selby Lowndes, writing in the *Field*, stated that he killed with five terriers 152 rats in an hour and a quarter.—A writer in the *Yorkshire Post* reported that 500 rats were slaughtered during one day in one vermin-infested farm building.—A rat-catcher in the employ of a railway company caught 380 at one time in some premises at Harborne, and 980 in one business house at Birmingham. His quarterly catches at New Street Station, Birmingham, number anything from 500 to 700, taken in two or three days. At Lime Street Station, Liverpool, he caught 200 in one day. From one old country mansion he has taken

answers to which must be obvious to anyone who thinks only for a moment of the number of the pantries, out-houses, shops, stores, and sewers to be found on one acre that has been built upon.

This enquiry gave a minimum of 40,000,000 rats for the British Isles, or (at least) as many rats as there are men, women, and children. In this form the estimate has become generally accepted.

FEEDING EXPERIMENTS.

To arrive at a reasonable and practical estimate of the damage done by rats proved a more difficult task. Whilst there was never a moment's hesitation on any one's part to agree with the "one rat per cultivated acre" estimate, opinions about the material loss caused by the rat ranged from "nothing a year" to the most extravagant figures. The secretary of an important agricultural society said at a certain meeting that, "at a guess," he should put the loss to farmers alone at one million pounds sterling per day! Professor Simpson gave it as his opinion that rats on board ship did "at

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as many as 100.—One farmer writes that he and his friend killed 118 out of one stack. How many made good their escape he could not say. —When, a few years ago, a large warehouse on the Blackfriars side of the Thames was burned to the water's edge, the surface of the river was black with thousands of evicted rats, enormous numbers of which were seen struggling, happily in vain, to climb the face of the Embankment on the opposite side.—Lord Gifford's tenantry in 1904 killed over 37,000 rats in a great campaign with ferrets, traps and poisons, on his estate of Old Park, Chichester (2,000 acres).—At Folkestone also, in the summer of 1904, a three days rat-hunt on a refuse heap resulted in 1,645 rats being killed.

least one pennyworth of damage per rat per day," Professor R. J. Anderson said that "in the United Kingdom rats are responsible for destruction to life and property not inferior to that caused by the tiger and cobra in India. Several people replied to my enquiry that "if the rats ever did any real damage, the loss was more than compensated by the incalculable amount of good done by them as scavengers"! Others, farmers, shopkeepers, and restaurant and hotel proprietors, stated that their loss through rats amounted to about 20s. per year per head of the people living and employed in the places under report.

In order to ascertain what I hope to see accepted as a reasonable estimate, I instituted a number of experiments with rats in cages. I placed in each cage three brown rats caught in houses, shops, or on farms, and placed them on a food allowance of one halfpenny per rat per day. One half of each cage was darkened and there was a plentiful supply of hay, straw, and rags. There were also placed in each cage a half-brick and a pound of beef bones, so that the rats might indulge in gnawing for the purpose of keeping their teeth sharpened. They were disturbed only once a day, in the morning, when they received their food allowance. The diet chosen was the kind of food which they would obtain for themselves in the free state : bread, potatoes, carrots, swedes, boiled and raw meat, fish, eggs, poultry, and offal.

In some of the experiments the rats were put on a meat diet for the first two days, on vegetarian diet the second two days, and so on, alternately. In the rest of

the experiments the rats received a mixed diet. The results were invariably the same, though after intervals of varying lengths. Usually after a few days of either diet one rat—of course always the weakest of the three—would be found dead and partly devoured ; and after a further interval one would invariably kill and devour the other of the surviving two. In the first series of experiments no notice was taken of the sex of the

ARE RATS CANNIBALS ?

Male rat killed and partly eaten by a female rat, kept in the same cage and fed on vegetarian food.

experimental animals or the survivors, but in the second series it was observed that all the survivors were doe rats.

The last surviving rat would soon become dull and listless, but retain its appetite, become more lively with

an increased diet, and again dull when put back on the halfpenny allowance. Those that were killed for *post-mortem* examination were emaciated, thus showing that a rat in captivity does not thrive on a halfpenny-worth of food per day, no matter what kind of food is bought so as to obtain the greatest amount of bulk.

It must be noted here that these experiments did not permit of ascertaining the additional amount of damage which the rats would have done by gnawing and burrowing, had they been in a state of freedom and not restricted by the four walls of a cage.

On the strength of these experiments, and the information obtained from other observers,[19] I felt justified in formulating the thesis that each rat causes, by the destruction of food and material, a loss amounting at least to one farthing per day. This, together with my estimate of the approximate number of rats, has now been accepted everywhere[20] as the foundation upon which to base the demand for concerted action; but, small as they may seem, they mean that the people of Great Britain lose every year through the destruction of food and

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[19] An estate agent writes: "On a thirty-acre field of wheat we killed 614 rats in one afternoon. How many hundreds got away I cannot say. The same evening we killed in the farm building 156 rats. I estimated the damage to this field at 150 bushels at the very lowest. I always say that on a rat-infested farm the tenant pays two rents, one to his landlord, the other to the rats. The latter is the heavier, but the farmer does not trouble. 'There always *was* rats and there always will be.'"

[20] In particular, by Mr. Shipley in his speech at the Congress of Economic Biologists at Edinburgh.

material by rats a sum of at least £15,000,000. This is bad enough, but what is worse, is that this loss is preventable; that a huge industry, with an aggregate capital of some two million pounds, has grown up for the supply of various means of rat destruction; and that though we spend enough money to keep this industry in an apparently flourishing condition, there is every indication that the rat plague in the British Isles is increasing from year to year.

As soon as the Incorporated Society for the Destruction of Vermin had formally adopted the policy advocated by me, and appointed a Sub-Committee charged with drafting a Bill on the lines of the successful Danish Rat Law, it was found advisable to extend the scope of the enquiries instituted by me, principally in order to obtain an opinion from as many persons as possible among those who had suffered loss through rats and were in a position to give information of habits, the approximate number, the damage done by them, and the most effective means of destruction. I was therefore requested to draw up a schedule, a copy of which I subjoin.

Date .....
County of .....
Town (Village) of .....
.....Street
Number of Inhabitants .....

(1) Name .....

(2) Description of place under report (state whether estate, farm, warehouse, factory, shop, &c.).

(2A) Approximate area in square yards.....

(2B) Number of persons living in the place .....

(2C) Number of persons employed in the place .....

Total.....

(2D) Describe the physical conditions of the district where your place is situated. Is there any factor favouring the existence of the rat plague ?

(3) How long has a rat plague existed, or how long have you been troubled with rats ?

(4) What are the particular kinds of loss inflicted by the rats ?

(*a*) Destruction of food.
(*b*) ,, material.
(*c*) ,, animal life.

(4A) Can you approximately state in £ s. d. the loss caused in any one year ?

In 190 about £
In 190 ,, £
In 190 ,, £

(5) What means have you employed for destroying the rats (rat-catchers, traps, poisons, what kind ; bacteriological preparations, what kind) ?

(5A) What was the cost per year. About £

(5B) Were the rats exterminated ?

(5C) How long did your place remain free from rats after using such measures ?

(6) In using a poison or a bacteriological preparation, have you suffered any loss through domestic animals dying from eating poison or virus or eating rats killed with poison or virus ? Please state full particulars.

(7) Have you made any systematic efforts to deal with the rat trouble, either alone or in co-operation with others ?

(7A) If so what were the means employed ?

(7B) What was the form of co-operation (state whether co-operation between neighbours, the residents of a parish, or several parishes, or of a rat and sparrow club) ?

(8) Can you state the approximate result of such systematic efforts ?

Number of rats killed in 190
,, ,, ,, 190
,, ,, ,, 190
,, ,, ,, 190
,, ,, ,, 190

Remarks :

(9) Can you mention any particular incidents illustrating the power of rats for doing injury ?

GENERAL OBSERVATIONS.

(1) In your experience, what is the best means on the market for destroying rats? (State what advantage it possesses, in your opinion, over other means.)

(2) Are you in favour of a proposal to multiply the number of the existing rat (and sparrow) clubs, organizing and co-ordinating them with similar agencies working for the extermination of rats?

(3) If so, are you in favour of an annual grant being made by the State for that purpose of say, £10,000?

STATISTICS.

(1) Is it in your opinion reasonable to assume (for the purpose of estimating the loss caused by rats, by the destruction of private and public wealth) that there is at least one rat to each acre of the total acreage of the United Kingdom?

(2) Is it in your opinion reasonable to assume that the number of rats present on farms, in hamlets and villages is at least equal to the number of inhabitants?

(3) Considering the greater facilities provided for rats in the town, as regards food and hiding places, is it reasonable to assume that there also are as many rats as human beings.

(4) Is it in your opinion reasonable to estimate the economic loss caused by rats (through eating and spoiling and destroying material) at one farthing per rat per day?

A tabulated summary of the replies that have so far come to hand will be published at the beginning of next session. Here it will be sufficient to state that the vast majority of those who have replied—99 per cent., including landowners, estate agents, farmers, breeders, shopkeepers of all kinds, owners of stores and factories, restaurant and hotel proprietors, shipping, dock, and colliery companies, sanitary inspectors, medical officers of health, borough surveyors, economic zoologists, and hundreds of private persons endorse the two estimates as "most reasonable." A very large per-

centage of correspondents, comparing my figures with the damage suffered by them, mark them as "far too low."

It is impossible to overrate the value of the information which has been brought to light so far by this schedule. Here for the first time we have a mass of well-authenticated evidence disclosing an almost incredible state of affairs. The rate has penetrated everywhere —it has eaten its evil way like a cancer, and the majority of people seem to regard it with the same hopelessness. "What is the good of our attempting to do anything?" they ask. "If I really start killing rats, those of my neighbours, B, C, and D, would only make up the losses as fast as I could inflict them." It is this utter want of acting co-operatively which is responsible for the spread of the rat plague in this country, and for the corresponding enormous amount of preventable damage. And individuals are not by any means the only sinners in this regard—the local authorities show the same supineness and indifference. I am quoting here from a few reports mainly to show the variety of the damage done by rats; hundreds of other instances may be seen in the files of the Incorporated Society for the Destruction of Vermin.

INSTANCES OF DAMAGE.

The manager of a famous library states that it costs them £150 to £200 a year for binding books that have been gnawed by rats.

Restaurant keeper in the City of London was literally brought to bankruptcy by the rats. On the premises adjoining his place being pulled down previous to rebuilding, the rats, disturbed in their old haunts, invaded his restaurant, and would not only dart about among the customers but would actually jump on a table, snatch a particle of food and dart away. One day during luncheon a big rat jumped from the stairs on to a lady's plate. In the chase that followed the rat was killed—and so was the man's business.

Grocer, who has been waging war against the rat for many years, says that the damage done by them has grown from £20 in 1905 to £35 in 1907.

Brewery in Scotland: Rats gnawed through some oak beams supporting an iron tank at the top of the building; the tank fell and smashed £2,000 worth of machinery.

Poultry farmer in Cumberland writes: "I am killing rats all the year round, but in spite of that cannot protect my poultry against them. I am losing chickens every week, but they do me most damage by sucking eggs. Last week the rats had over one hundred eggs in one night. Some eggs we found next morning close to their holes.[21] How they got there I do not know, but there they were, right enough, and not broken or cracked either."

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[21] Several correspondents have been good enough to tell me that someone has assured them that he or she saw with his or her own eyes a rat walking upstairs, standing on its hind legs, and carrying an egg in its fore-paws. Others say that they have seen—or heard of—two rats performing the egg trick, one on the lower step "handing"

An estate agent says that the damage done by rats on the estate under his management (30,000 acres) was

IVORY BALL GNAWED BY RATS.[22]

at least 1s. 6d. per acre before suitable remedies were supplied.

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the egg to its mate on the upper step, and so on. Two veracious correspondents witnessed how one rat was lying on its back holding an egg between its four legs, whilst another rat was pulling its mate along barrow-fashion by the tail. Readers will remember that this situation was long ago described by Lafontaine in his story of the Two Rats, the

Secretary of a famous soap factory writes: "The rats cost us £500 at the very lowest computation."

Manager of a seed farm states that "the rats destroy and spoil annually at least £1,000 worth of seed and plants."

A leather manufacturer writes: "I think myself lucky if I get off with £1 of damage per week, but it is only rarely that I am let off so cheaply. The rats gnaw holes into the skins and spoil a set of harness in a few minutes."[23]

An army officer writes that he had to give up his mansion in Scotland because neither he nor his family could get any sleep at nights for the rats.

Estate agent in Staffordshire: "The task of prevent-

Fox and the Egg. The necessity of saving the egg from the fox inspires the two rats with a brilliant idea:

> "L'un se met sur le dos, prend l'œuf entre ses bras,
> Puis, malgré quelques heurts et quelques mauvais pas.
> L'autre le traîne par la queue. . . . "

Lydekker, in speaking of the cleverness of the rat, says that, "in robbing poultry-houses, it is a well-ascertained fact that the rats will convey the eggs in an unbroken condition for considerable distances, although it is not yet ascertained how this difficult feat is accomplished."

[22] Its instinct is no less shown in the selection of suitable food. It attacks the portion of the elephant's tusk that abounds with animal oil, in preference to that which contains phosphate of lime; and the rat-gnawn ivory is selected by the turner as fitted for billiard balls and other articles where the qualities of elasticity and transparency are required.

[23] There are many historical cases on record showing the damage done by rats and "mice." Herodotus says that when Sennacherib, King of the Arabians and Assyrians, was attacking Egypt and encamped before Pelusium, a number of "field-mice" pouring in upon his army destroyed all the quivers and bows, and the handles of the shields, so

ing damage done by rats seems so hopeless that I have kept no account of the various incidents and the approximate amount of damage done by them ; however, since seeing your letter in the Press I have kept a note, and find that the loss in grain, food, material, game and poultry, as far as I have been able to ascertain, is about £34 in two months on five farms."

Farmer in Scotland : "I spend £3 to £4 a year on various means for exterminating rats, and am as a rule fairly free. Some weeks ago, however, the rats raided my place and destroyed poultry to the value of £8 10s."

House factors in Glasgow : "The portion of our repairing bill due to rats varies between £200 and £400 a year."

Boot manufacturer writes ; "The rats do us an incredible amount of damage. This place is near the river, and no matter what we do, we cannot keep them out. Last year the rats destroyed three pairs of riding boots.[24] A few months ago they reduced to bits a whole case of ladies' high-legged boots. They did not merely

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that on the next day when they fled bereft of their bows, many of them fell. And to this day a stone statue of this king stands in the temple of Vulcan, with a mouse in his hand, and an inscription to the following effect : "Whoever looks on me, let him revere the gods" ("Euterpe").

[24] A similar case is related by Cicero. Among the Romans rats and mice were regarded as being of evil omen. An augur who, during the solemn act of inspecting the entrails of an animal or observing the flight or feeding of birds as a means of penetrating the future, would hear the squealing of a rat or mouse, would immediately cease the rite, considering such interruption as fatal. "We have become so foolish," writes Cicero, "that if the rats should destroy anything we consider it a bad

nibble them or eat holes into them, but literally ground them up, leaving nothing but bits of leather and metal, and scraps of the cardboard boxes. There is not a day without some kind of damage from them."

Professor of Economic Zoology : "I lost poultry to the value of £6 in 1905, and about £4 in 1906."

Poultry farmer in Dorset : "My loss in poultry caused by the rats last year was about £80. The damage caused to material it is impossible to estimate. but I should say it would not be less than £50."

Devonshire farmer writes : "I kill rats systematically. I destroyed 900 in 1905, 1,600 in 1906, and 1,300 in 1907. At the beginning of this year I lost a valuable pony which had broken its leg through falling through a cemented floor that had been undermined by rats. It is useless to attempt to estimate the damage done to material and poultry, but I should be very pleased to compound with the rats for £30 a year."

Manager of a large flour mill places the damage to sacks at £150 yearly at the lowest.

Manager of a large firm of sheet iron manufacturers writes : "The rats cost us at least 20s. per month ; they come here for the bran we use in manufacturing, and devour incredible quantities."

Farmer in Berwickshire : "I am always killing rats, but all efforts seem useless, as there are too many of them.

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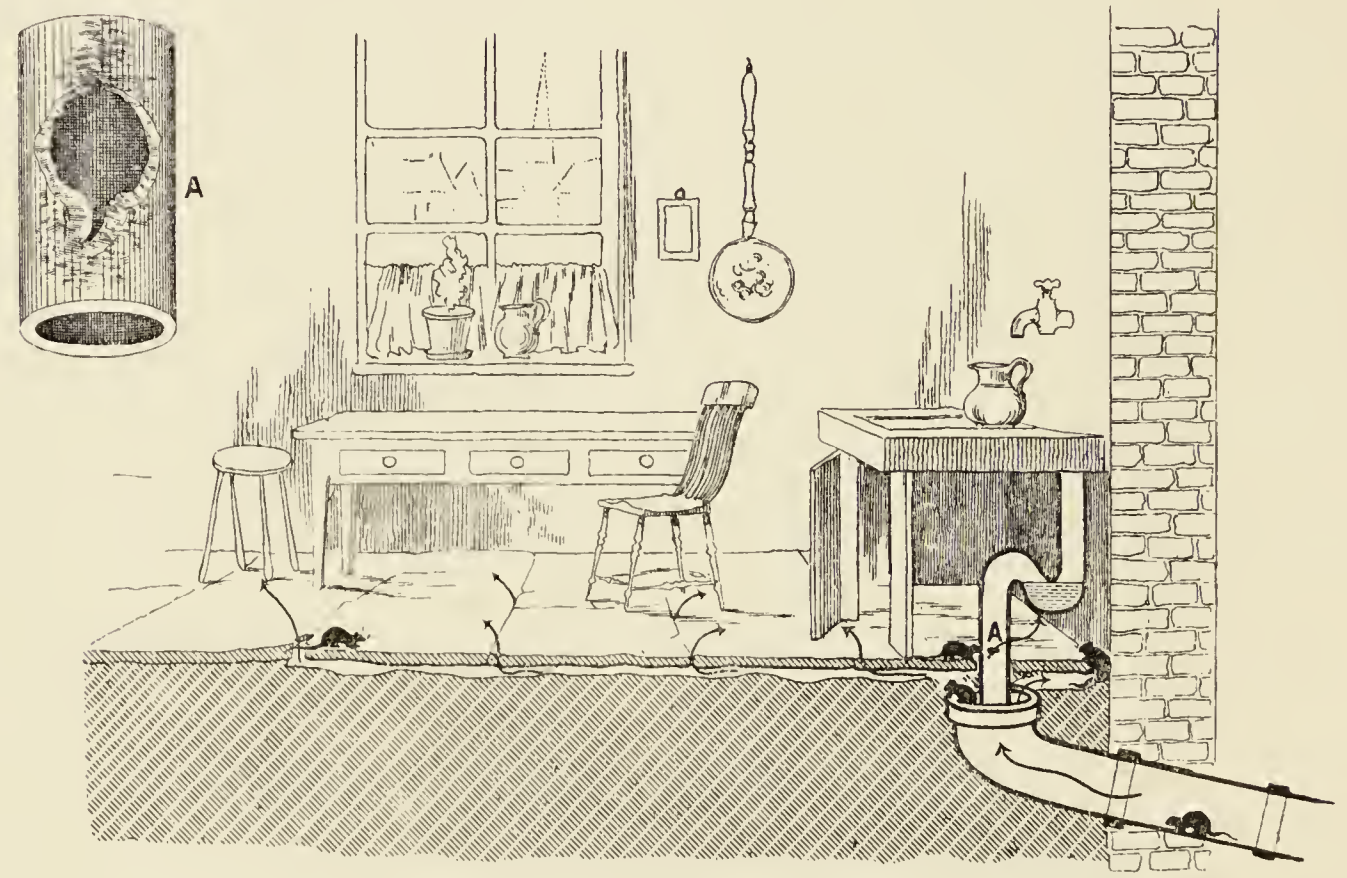
sign." Cato, when asked one day, by someone whose boots had been eaten by rats, what evil this might portend, said : "Nothing whatever ; but if you had told me that the boots had eaten the rats I should warn you to be prepared for the most awful consequences."

SOIL-PIPES GNAWED BY RATS.

I do not only suffer from the rats which are always here, but sometimes they come in droves from other places. One lot came last week and destroyed two acres of

cabbage. There was not five shillings' worth left when they had finished. I am sure if I could save what the rats eat, spoil and destroy, it would pay the rent, and I am paying £200.

Gamekeeper on an estate of 15,000 acres has killed on an average 5,000 rats a year for thirty-five years, but says: "The damage the rats do is incredible, especially



RATS AND SEWER GAS.[25]

to game. It is a great deal higher than your estimate of one farthing. It is no use thinking of keeping an account. There is too much of it, what we see, and we only see the smallest part."

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[25] Pridgin Teale, in his valuable book "Dangers to Health," from which this illustration is taken, says: "When rats appear in a kitchen or cellar the presumption is that they come out of a drain. A hole in a

Kent farmer : "On opening a rat-hole I found at the bottom a hen's egg, which must have only quite recently been carried into it, as it was quite fresh. In order to get to their nest the rats had to cross a beam 8 in. high, and they must have lifted the egg over that beam, too. Anyway, I could not find any other road along which the egg might have come. I may say that the egg had not a single crack."

A lady reports : "The rats gnawed through a water-pipe at the top of our house and we were flooded out. The water spoilt some carpets, the wallpaper and plaster in several rooms, several pictures, hangings, &c. . . . We had to go away for five weeks. When my sister

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drain which permits the escape of a rat will allow the sewer gas to be drawn into a house *pleno flumine*.

"When a waste-pipe or a sink joins a drain under a kitchen floor instead of discharging into a gully outside, this is what usually happens. The sink-pipe, religiously trapped, passes neatly through the kitchen floor. Beneath the floor and out of sight it passes into an open wide-mouthed drain-pipe, 4 or 6 in. in diameter, with neither cement nor luting to bar the escape of rats or sewer gas. This piece of scamping being out of sight is exceedingly common, and is often overlooked by Inspectors who satisfy themselves with a peep at the syphon trap, and take no account of the gaping pipe concealed beneath the flag, ready to let the rat and the gas out of the drain.

"Even if cement were used it would be no sufficient protection against the rats making their way into the house.

"In two other ways rats do mischief—one, by eating through the lead pipes to reach water or fat ; the other, by making runs under drain-pipes and letting down and opening the joints.

"Open drain joints concealed under a cellar floor can often be detected in the following way : Shut all windows and outer doors ; open all doors between the cellar and the fires in the house ; then hold a lighted taper opposite any crevices or fissures such as are shown by the black arrows."

and I came to reckon up, the hotel and repair bills came to £71."

Wholesale grocer writes that the rats had hollowed out a number of sugarloaves so dextrously that only the paper remained.

Gentleman farmer in Oxfordshire writes: "Rats have on various occasions killed turkeys sitting on eggs, and one of my horses was lamed through being badly bitten by rats in his hoof and coronet. As to the material damage done by the rats, it is far too much and varied to attempt to estimate it."

The managing director of a large firm of drapers in the City of London writes: "Since reading your estimate of the damage done by rats, I have given instructions to report to me cases of damage occurring in any of our departments. During the fortnight under observation it seems that the total loss amounts to £28, but I think, at any rate I hope, that this is exceptional."

(Second report.) "At your suggestion I instituted another test, but the results are worse still. Some rats got into the silk department and have wrought havoc. Among other things, they, or one rat I think, gnawed through a pile of silk dressing-gowns. The total damage is about £80. Another rat in the same week gnawed through a water-pipe and flooded several cellars. In this case the damage was over £20."

Manager of a colliery: "You would hardly believe that the rats have forced us and the miners to alter long-established methods and habits. Our men have always been accustomed to bring their food in canvas bags and

put it with their coats on the ground. Since the mine became infested there have been thousands of cases where the bags, and often the protecting coats, have been gnawed through and all food abstracted.

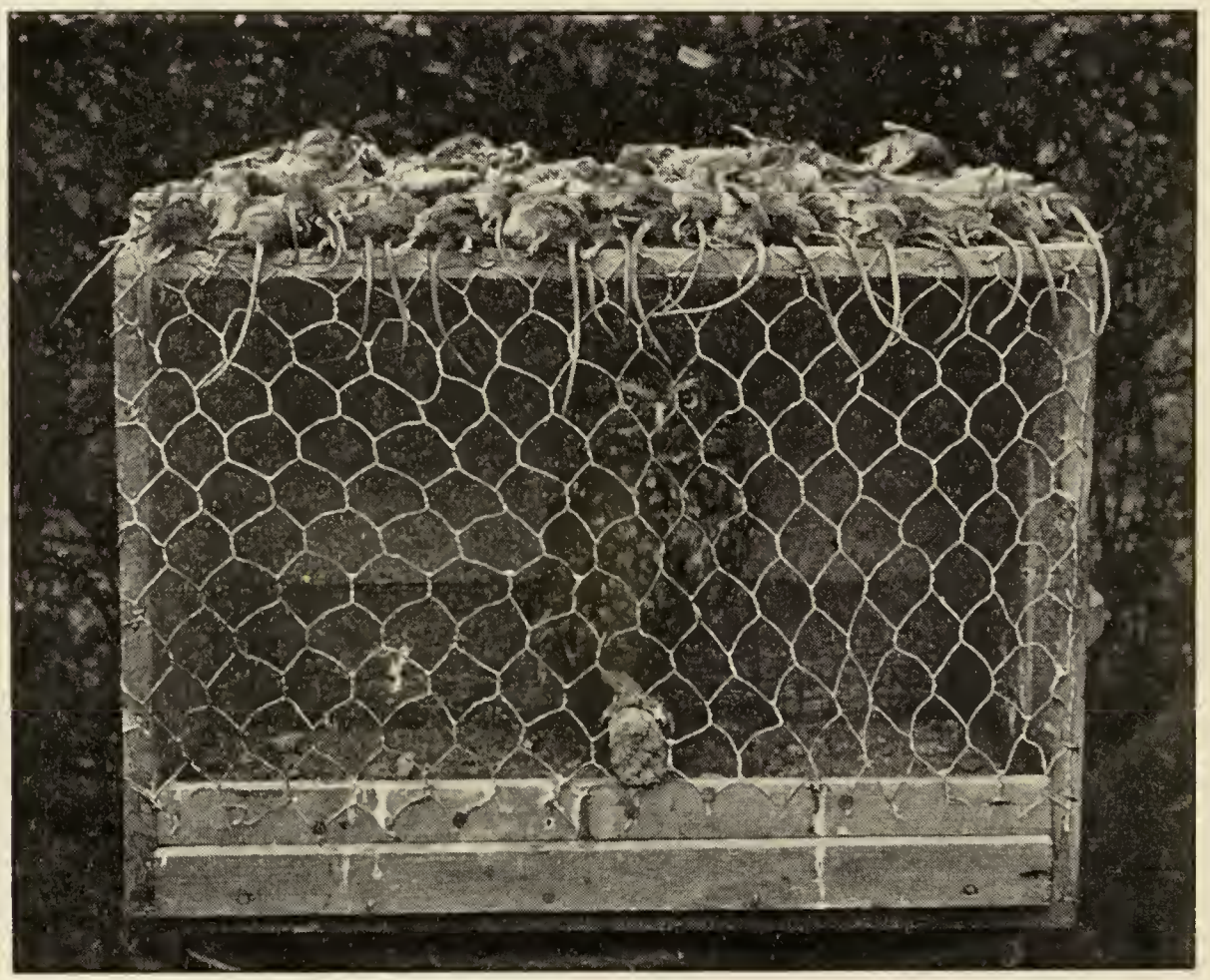
"In the stables it was the custom for two men to commence at one o'clock every afternoon to put the horses' food ready for their return at 3.30, but when the rats came down they soon multiplied enormously, and became so bold that they would eat all the corn out of the manger, leaving only the chaff. We are now forced to start at 3 o'clock to get the mangers ready. That means, of course, extra staff. Even then the stable-men must patrol the stable, beating the mangers with sticks in order to frighten the rats away. But even then you can, if you go close enough, see now and then rats sitting in a corner of a manger, contentedly munching oats.

"Formerly we used to employ boys for opening and closing the ventilation doors to enable the trains to pass, but, as several of these lads were attacked by rats, we cannot get any of these boys now, and must employ men at men's wages to do boys' work.

"Under the system of ventilation in our mine it is necessary to keep certain worked-out portions walled up air-tight to secure a perfect current. But the rats burrow every now and then through the tops of these walls, with the result that we are put to endless trouble and expense to find the 'faults,' make the damage good, and correct the current.

"Finally, I feel tolerably certain that the epidemic

of horse-influenza, during which we lost over a dozen horses, was brought by rats that came from the neighbouring colliery where the epidemic was raging. We know that the rats can make their way from one mine to another, and no other cause of infection is conceivable."



AN OWL AND ITS LARDER.

CHAPTER III.

On the *rôle* Played by the Rat in the Dissemination of Disease.

Great as is the economic loss caused by the rat through the destruction of food and material, it can bear no comparison to the injury inflicted by this animal to the health and life of domestic animals and man himself, for to-day we know beyond any doubt that the rat is the connecting link in the chain along which *Trichina spiralis* reaches man, to produce trichinosis, and *Bacillus pestis bubonicæ*, to strike him down with the terrible plague.

Trichina spiralis is a minute parasitic nematode, occurring chiefly in man, pig, and rat. The adult trichinæ are found only in the intestines, and especially in the smaller intestines, of mammals and birds which have recently eaten trichinous flesh.[1]

After ingestion the cysts enveloping the muscle trichinæ are dissolved by the gastric juice in about eighteen to twenty hours and the worms are set free. On the

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[1] Neumann, "Parasites."

second to fourth day these larvæ have undergone transformation which brings them to the adult form. The males are generally smaller than the females. Copulation takes place, and ovulation commences towards the sixth or seventh day, the embryos of a single female numbering from 1,200 frequently to 15,000.

The embryos deposited in crowds in the intestines become developed only after migrating into the striped muscles and connective tissue in every part of the body. The duration of these migrations is about eight to ten days. The effect of these wanderings, and of the presence of trichinæ in the muscles of man is to produce changes which are designated as trichinosis or trichiniasis, a disease from which man frequently dies.

It is in eating the flesh of a trichinous pig that man contracts trichinosis. The pig has been contaminated by the ingestion of trichinous meat and of an animal, chiefly the brown rat (sometimes the mouse), or its coprophagous habits have allowed it to be infected by devouring rat excreta containing adult or embryonic trichinæ. Thus we get the chain or circle :—

(1) Rat eats trichinous meat or dejecta containing trichinæ.

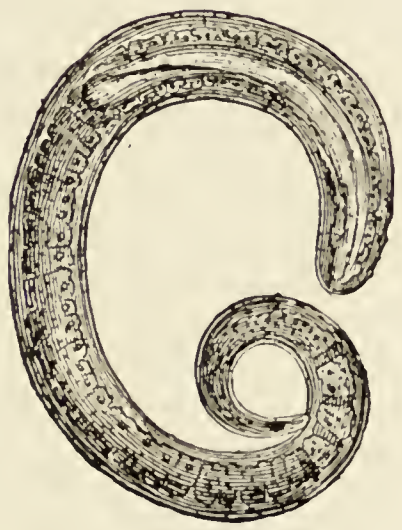
(2) Pig eats trichinous rat, or, with the food, dejecta of trichinous rat.

(3) Man eats in trichinous pork some embryonic or adult trichinæ.

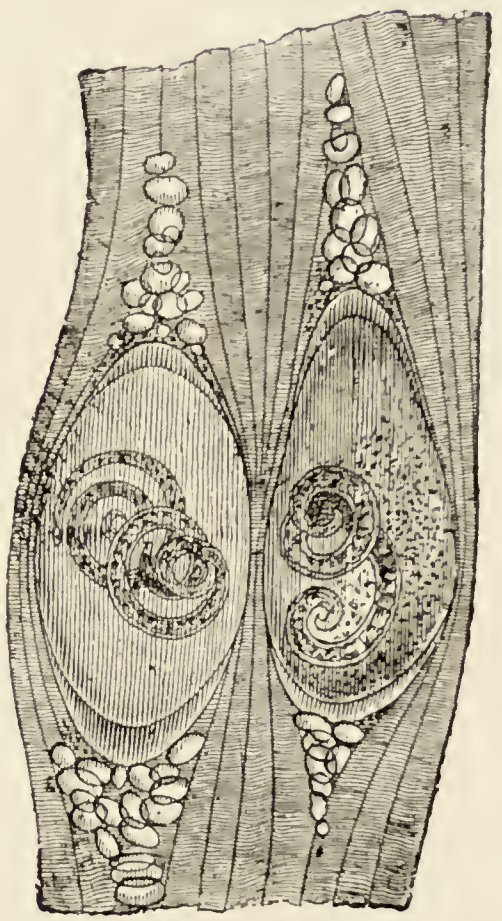
It is noteworthy that an epidemic of trichinosis is found only where the brown rat is also found ; though isolated cases of trichinosis occur by direct infection

through meat coming from a distance—as in the case of trichinosis which occurred in Glasgow.

The *Medical Press* said with reference to this case: "If the rat needed one more nail in his coffin it ought to be supplied by the discovery in the Glasgow City



TRICHINA SPIRALIS



ENCYSTED TRICHINA.

Abattoir of the fact that 3 per cent. of the rats killed on the premises are infected wlth *Trichina spiralis*. It is believed that the parasite is obtained by the eating of the trimmings of condemned pork. Now, however

well-kept an abattoir may be, there is always a great difficulty with rats, which find it a particularly attractive centre for their feeding operations, and if only a few of the infected escape, the danger of their spreading trichinosis among the community is a grave one. On the other hand, it ought to be possible, and not only possible but imperative, that condemned carcases and trimmings should be promptly disposed of by fire, so that no chance of their being eaten by rats or by man can arise. American meat, in spite of President Roosevelt's new law, is often but poorly inspected before it leaves that country, and it is by no means safe to rely on the care and discretion exercised at the other end. British Inspectors must rely on their own efforts and their own judgment, and when they have condemned a carcase it should be destroyed before there is a chance of its doing further harm. If an outbreak of trichinosis occurred in Glasgow or the neighbourhood, the officials, now that they have received their warning, should be held responsible."

The presence of the brown rat is an indispensable condition to the spread of epidemic trichinosis. No sooner, therefore, has a case of trichinosis been reported to the health authorities in Germany than the wholesale destruction of rats is undertaken as a matter of course. Experience has taught the German Government that by breaking the connecting link in the chain they make an epidemic of trichinosis impossible.

Bubonic Plague.

Though mankind has been groping about for many centuries in an endeavour to find the truth, more or less dimly suspected, about the part played by the rat in the dissemination of the plague[2] (black death), it has been left to our days to prove beyond doubt, by the discovery of the plague bacillus in the rat, that there can be no epidemic of plague unless an epizootic of rats has preceded it.

Of the relationship of the rat to the plague we hear first in Syria, 3,000 years ago, when, during a war with the Israelites, the Philistines were smitten with the plague. In one town alone, Ashdod, 50,000 people died.[3] Then the priests of the Philistines told the people to take a propitiatory offering to the God of Israel, in the shape of "five golden images of the emerods in their secret parts, and five golden images of the mice that marred the land."[4]

Avicenna recognised a connection between rat and plague during the outbreak in Mesopotamia, and refers to the fact that, on the approach of plague, mice and

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[2] Apollo, the plague, and mouse-god of the Greeks, is represented holding in one hand the bow and in the other the still more dangerous mouse. We find him as plague-sender in the first song of the Iliad, where he smites the Greeks with this sickness as a punishment for Agamemnon's crime against the daughter of the priest Chryses. The mice were his messengers, and a number of white mice were fed on his altar.

[3] Poussin, in his famous painting in the Louvre: "The Plague of the Philistines," represents a number of persons dying in the streets, whilst rats and mice are walking about spreading infection.

[4] 1 Samuel, v. and vi.

other animals which usually live underground[5] leave their holes and move about in a staggering manner as if they

THE PLAGUE AT ASHDOD. AFTER POUSSIN.

were drunk. The inhabitants of Hindustan were at one time familiar with the connection between rat mortality

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[5] The Chinese have believed for centuries that plague is a soil disease, attacking first the animals that burrow in the ground.

and plague, for in the "Bhavagta Purana," written more than 800 years ago, they are instructed to leave their

CASE OF BUBONIC PLAGUE.

dwellings immediately they notice a mortality among rats.

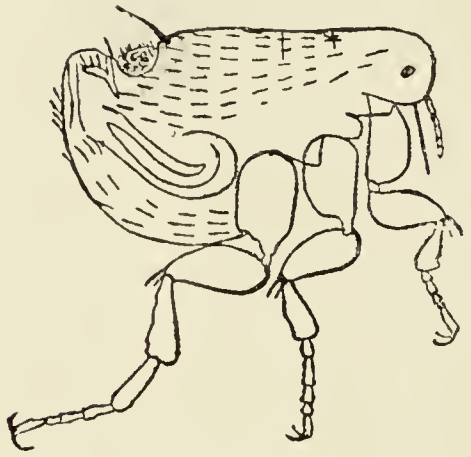
Bernardus Gordonius says: "At the same time the

birds abandon their nests and eggs, and numerous reptiles appear on the surface of the earth; these are certain signs of an approaching epidemic."

In the Great Plague of 1348, other animals besides

NESOKIA BENGALENSIS.

♂ Pulex cheopis

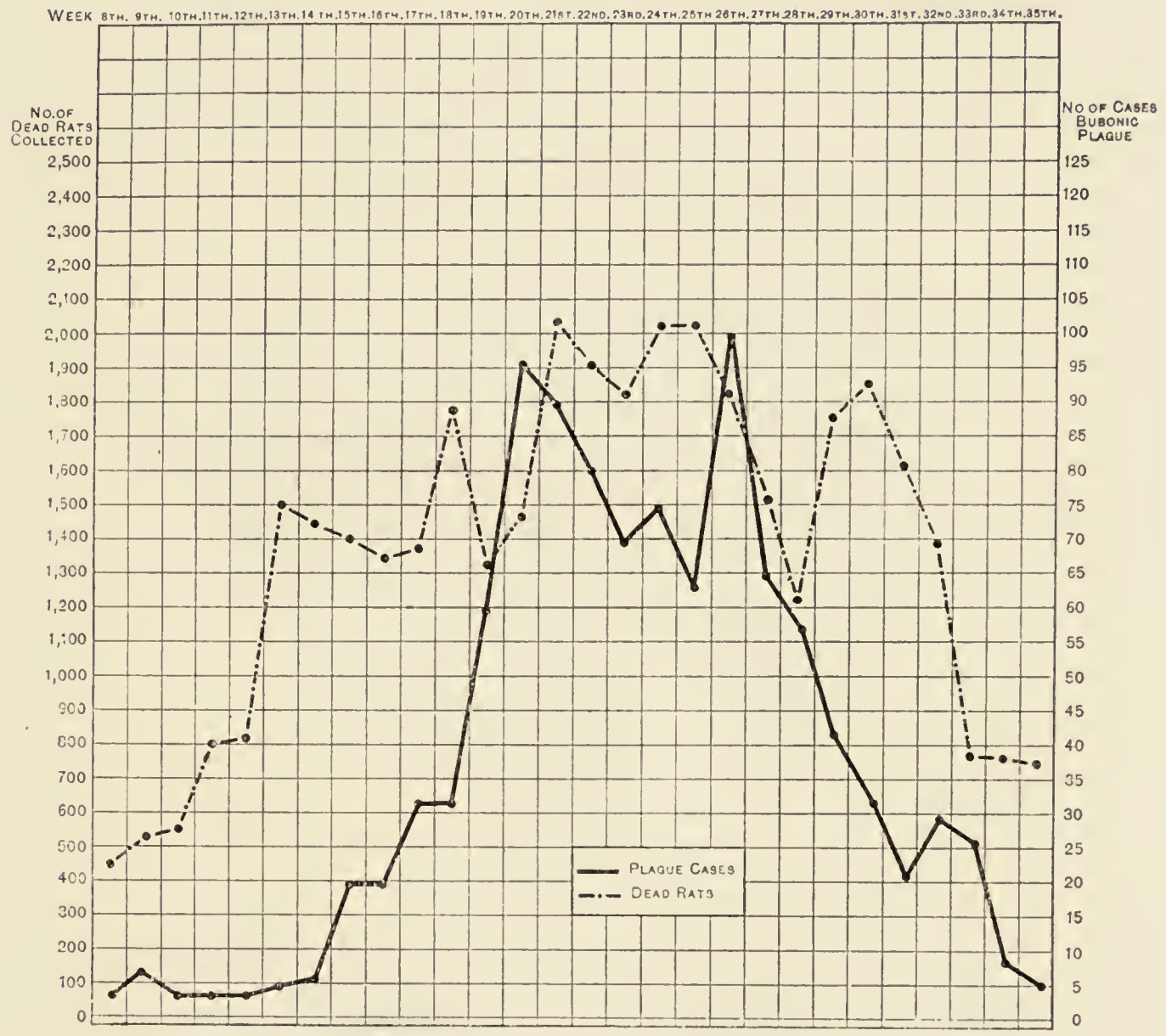


THE PLAGUE FLEA.

rats are mentioned as having been affected. Nicephorus Gregoras says: "Nor was it mankind alone that the plague thus harrasses as with a scourge, but all other animals that dwell with or associate with human beings took the disease; dogs and horses, and fowls as well,

and even the 'mice' that lived within the walls of their houses."

In writing of the plague in London, Lodge[6] mentions



rats and moles and other creatures accustomed to living underground, forsaking their holes and habitation, owing to the corruption of the soil.

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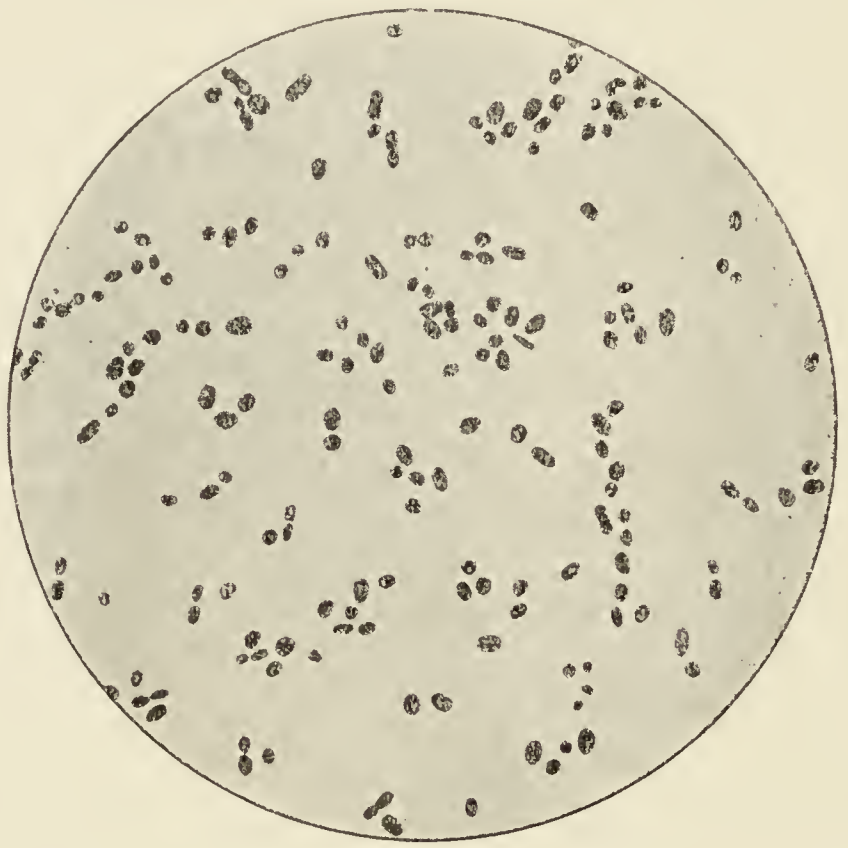
[6] "A Treatise of the Plague," by Thomas Lodge, Doctor in Physics, 1603.

Dr. Hodges[7] says : "Subterranean animals such as moles, mice, serpents, conies, foxes, &c., as conscious of approaching mischief, leave their burrows, and lie in the open air, which is also a certain sign of pestilence in the land at hand."



BACILLUS PESTIS.

Coming to modern times, almost all investigators since 1820, without exception, agree that great mortality among rats preceded the epidemics of plague under investigation ; and the report of the Plague Committee appointed by the Secretary of State for India has set all doubts on that point finally at rest.

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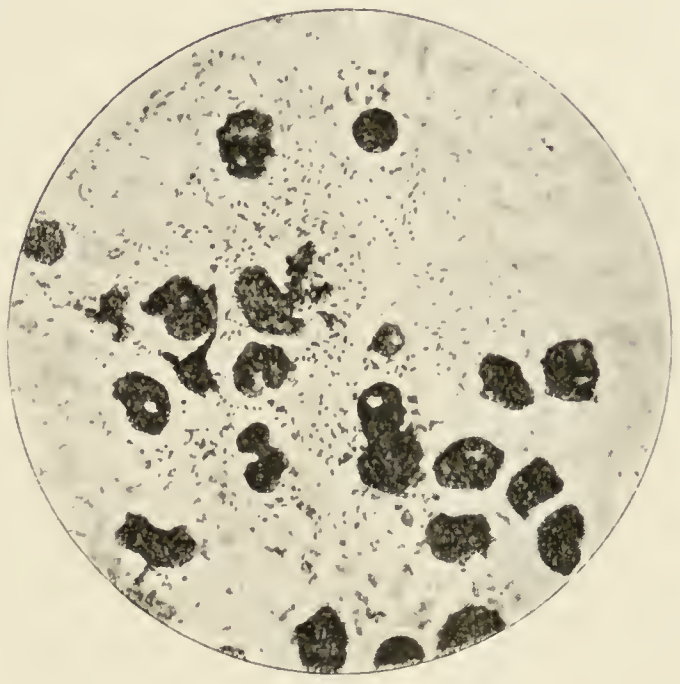
[7] "Loimologia : or an Historical Account of the Plague in London in 1665," by Nathaniel Hodges, M.D.

We now know that plague is carried slowly hither and thither by rats containing the plague bacillus in their bodies and in their excretions. The plague flea (*Pulex cheopis*), having fed on a plague-stricken rat, reaches a healthy rat or native, and when hungry transmits the plague bacillus whilst feeding. Though the rat is by no means the only agent in carrying the plague flea and



INVOLUTION FORM OF B. PESTIS.

the plague bacillus, it is, owing to its ubiquity and its power to "get anywhere," the most potent factor in the dissemination of plague, and any scheme aiming at the stamping out of the plague, or even a partial reduction, must include as a first and foremost measure the destruction of rats.[8]

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[8] The number of deaths from plague reported in India during 1907 was 1,204,194, and during the first eight months of 1908, 116,996.

CHAPTER IV.

On the Means for the Extermination of Rats.

Whatever may have been the cause of the rat plague in other countries, of the British Isles it is undoubtedly true that one of the chief factors operating in favour of

WEASEL AND ERMINE IN THEIR WINTER CLOTHING..

the multiplication of the rat has been the ruthless destruction of some of the rat's natural enemies, the owl, the weasel, and kestrel. Not content with providing

STATUE OF A HAWK.

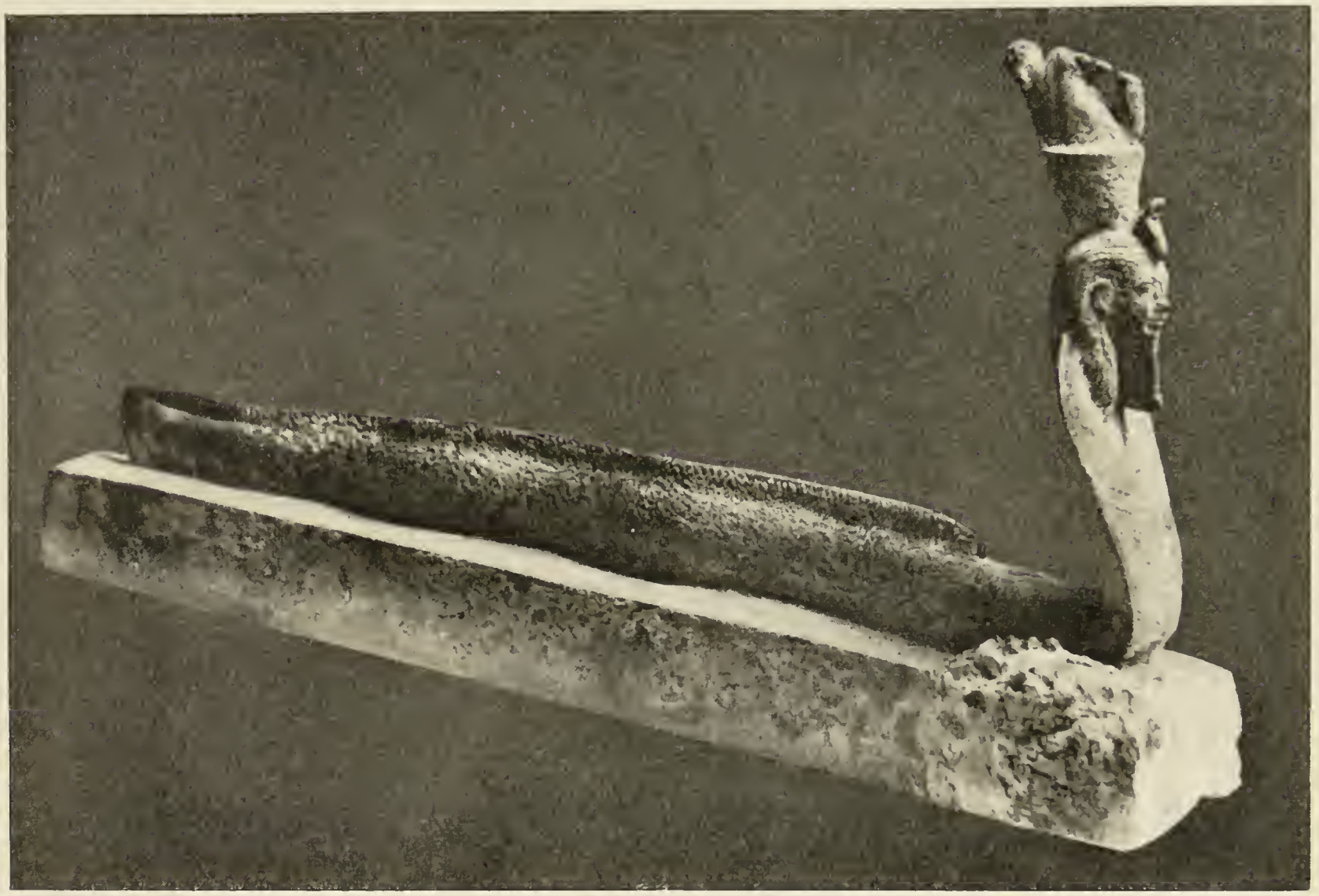
FECUNDITY TABLE.

After Zuschlag

								Litters.*
One pair of rats...	1 doe has a litter	Dec. 29	Feb. 15	April 1	May 15	July 1	Aug. 15	6 of 8 = 48.
1st generation :								
First litter ...	4 does have litters	April 15 (*a*)	June 1 (*a*)	July 15 (*a*)	Sept. 1 (*a*)	...	4 by 4	Of 8 = 128.
Second litter (*b*)	4 does have litters	June 1	July 15	Sept. 1	...	...	3 by 4	Of 8 = 96.
Third litter (*c*)...	4 does have litters	July 15 (*c*)	Sept. 1 (*c*)	...	...	...	2 by 4	Of 8 = 64.
Fourth litter ...	4 does have litters	Sept. 1 (*d*)	...	...	...	...	1 by 4	Of 8 = 32.
2nd generation :								
First litter (*a*) ...	16 does have litters	Aug. 1	Sept. 15	...	...	...	2 by 16	Of 8 = 256.
Second litter (*a*)	... ...	Sept. 15	...	...	...	....	1 by 16	Of 8 = 128.
First litter (*b*) ...	16 does have litters	,, ,,	...	...	...	...	1 by 16	Of 8 = 128.
								Total 880

* Brehm records a case of a litter of twenty-one. An old London rat-catcher told me that it was not at all unusual to find more than one dozen in a litter. He seemed to regard that rather as the rule.

for the rat, with the increase of population and a corresponding increase in the number of houses and food stores, better facilities for feeding, hiding, and breeding, man must also needs kill off the very animals that have been able to keep some check on a practically unlimited



BRONZE CASE AND IMAGE OF A SNAKE.

increase of the rat tribe, just because the owl, the weasel and the kestrel would sometimes vary their rat-and mouse diet with an occasional young pheasant or rabbit. Finding the balance of Nature thus disturbed by man

enormously in its favour, the rat was not slow in taking advantage of these favourable conditions, and aided by an enormous fecundity[1] it soon became the very serious problem with which we are to-day everywhere confronted.

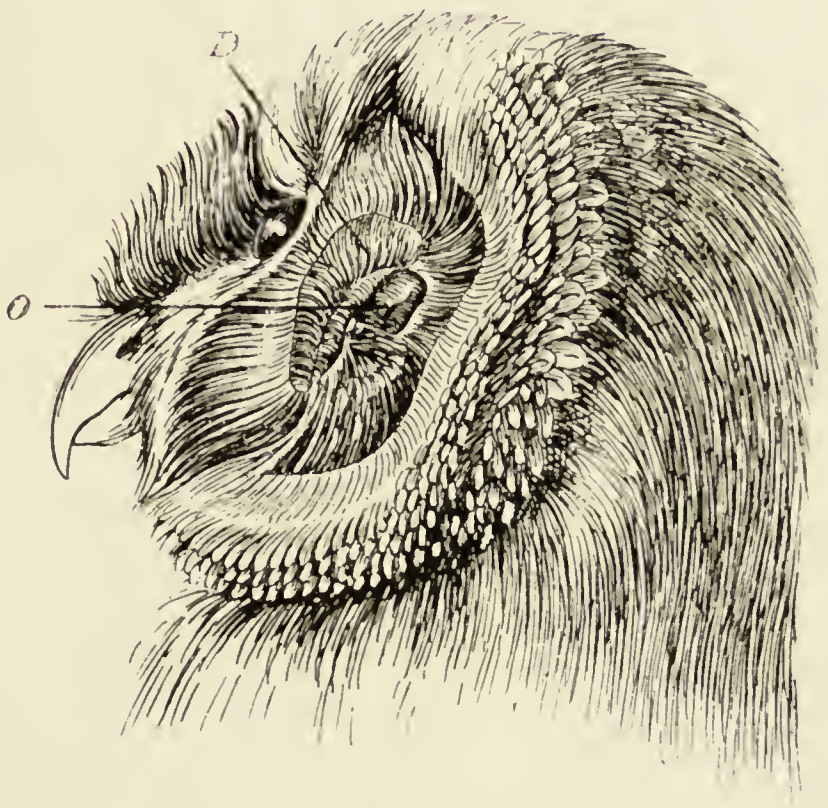
How can we best prevent the senseless waste of private and public wealth due to the presence of millions

SEAL OF THE DANISH SOCIETY FOR THE EXTERMINATION OF RATS.

of rats? And what is more important, how can we prevent the awful loss of life in various parts of the Empire due to the plague? Finally, how can we make sure against the plague gaining a foothold some day in England? To the man in the street the danger of plague seems a far-off cry, but not so to the port medical officers, that devoted little band of outposts who are keeping a ceaseless watch on every ship coming to these shores from foreign lands, always alert to the slightest

[1] See Fecundity Table, page 88.

sign of danger, waging a relentless war against the rats. So far the careful watch and persisting efforts of those men have succeeded in preventing the black death from once more invading these shores and stalking through the land, but what if some day, by dire mischance, a plague-infested rat should succeed in evading their watchfulness and make its way inland, finding its way to its



THE EAR OF THE BARN OWL. *O*, Opening of the ear; *D*, ear cover.

fellows? Then it will be too late to deplore the fact that because of our appalling indifference there will be millions of rats ready to spread the deadly plague far and wide.

It seems clear that one of the first steps to be taken in a war *à outrance* against the rat should be the protection of its natural enemies. Among these the barn owl (*Strix flammea*) is probably the most valuable ally of man. Hated by the ignorant gamekeeper, it is, nevertheless,

the game-preserver's and farmer's best friend. Though it may occasionally kill a singing bird or young pheasant, its chief nourishment is furnished by mice and young rats, so that it has been justly called the flying cat.

As many as twenty freshly killed rats have been found in a single owl's nest, and to judge by a proof supplied by the bird itself, the total number of rats, mice and moles destroyed by the barn owl must be enormous.

FACE OF THE BARN OWL, *Strix flammea.*

All owls have the habit of casting up the indigestible parts of the food swallowed by them in the form of pellets, which may often be found in abundance under the owl's roost and reveal without any manner of doubt what the prey of the bird has been. The results in nearly every case show the enormous service they render to men in destroying rats and mice.

"As owls subsist entirely on living prey, which at night must be closely approached before they can be

detected, an absolutely silent flight is essential, and this is effected by the soft and fluffy nature of their plumage. It is doubtless from their ghostlike stealthy flight, coupled with their nocturnal habits, their large glaring eyes, and their weird hootings and screechings, that these birds have in all ages and in all countries been regarded as creatures of ill omen. Because of an unreasonable animosity, owls are mercilessly shot down both by the gamekeeper and farmer, but there is some reason to believe that the latter at least is beginning to see the error of his ways."[2]

COMMON WEASEL, *Mustela vulgaris.*

The weasel (*Putela vulgaris*) is another relentless enemy of the rat. A magnificent hunter and fighter, it

[2] Lydekker, "Royal Natural History."

LATINE Muſtela.

ITAL. Donnola, uel Ballottula,
Benula.

GALL. Belette, uel Belotte.

GERMAN. Wiſele.

FROM GESNER, *Icones Animalium.*

chases the rat in its hole and kills annually immense numbers. It is often confused with the stoat, which is

brown above, dirty white beneath, the tail always black at the tip, longer and more bushy than that of the weasel. The stoat is twice as long as its elegant little congener, which is red above, pure white beneath, the tail red and uniform. Their habits differ in many of their details, and the crimes which the weasel is said to perpetrate in the farmyard and the hen-roost, as well as amongst game of every description, on hares and rabbits no less than on the feathered tribe, are principally due to the stoat. The weasel lives in hedges, woods, among stones and along the edge of swamps. It preys on many small creatures, such as moles, shrews, insects and birds, but chiefly on rats and mice.

PINE MARTEN, *Martes abietum*.

The pine marten (*Mustela martes*) is another merciless enemy of the rat. It does not exhibit, as the name

would indicate, an especial predilection for pine-forests, but it would seem that the name was given merely from the circumstances that pine-forests are abundant in many of the districts which it inhabits. It feeds on squirrels, birds and other small animals, in particular rats, mice, and moles.

THE COMMON KESTREL, *F. tinnunculus.*

The common or true kestrel (*Falco tinnunculus*) derives its other name of wind-hover from its habit of hanging suspended in mid-air, with its wings in rapid motion, its fan-like tail spread out, and its head directed to windward.

When in this position it spies a rat or mouse it drops upon it suddenly and noiselessly with unerring aim. Although its chief food consists of rats, mice and moles, the kestrel occasionally kills small birds, and will also eat frogs, beetles, worms and grubs. That it will now and then poach a young partridge[3] or chicken is doubtless true, but such small robberies are more than counter-balanced by the benefits it confers on the agriculturist by the destruction of hosts of pernicious rodents. It

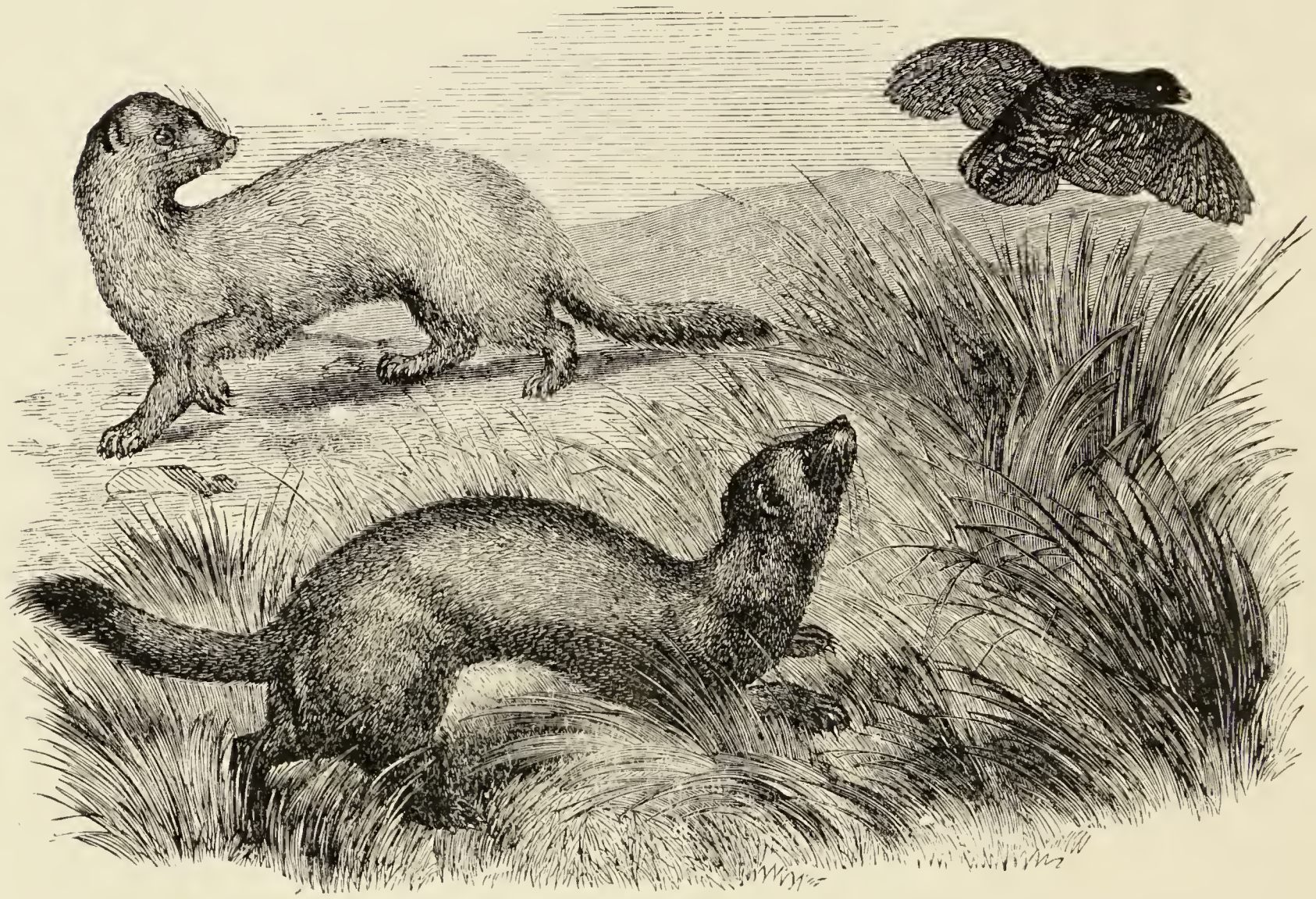
POLECAT (FITCHERT WEASEL), *Mustela putorius.*

ought, therefore, to be carefully preserved, instead of being ruthlessly shot down.

The ferret is a variety of the polecat, somewhat

[3] It seems that the kestrel is, in the first place, attracted by the pheasants' food, and finding that young pheasants are "good to eat," it will now and then vary its diet of rat and mouse with pheasant *à la tartare.*

qualified by the effects of long-continued activity. It is bred chiefly for rabbit-hunting. There are two different colours in ferrets, one a rich brown and tan, the other white with pink eyes. This is preferred by most for rat-catching.[4] The female ferret should always be used,



FERRET AND POLECAT.

as it is not half the size of the male, and can therefore follow the rat faster and better in narrow holes. The male ferrets should be kept entirely for rabbiting.

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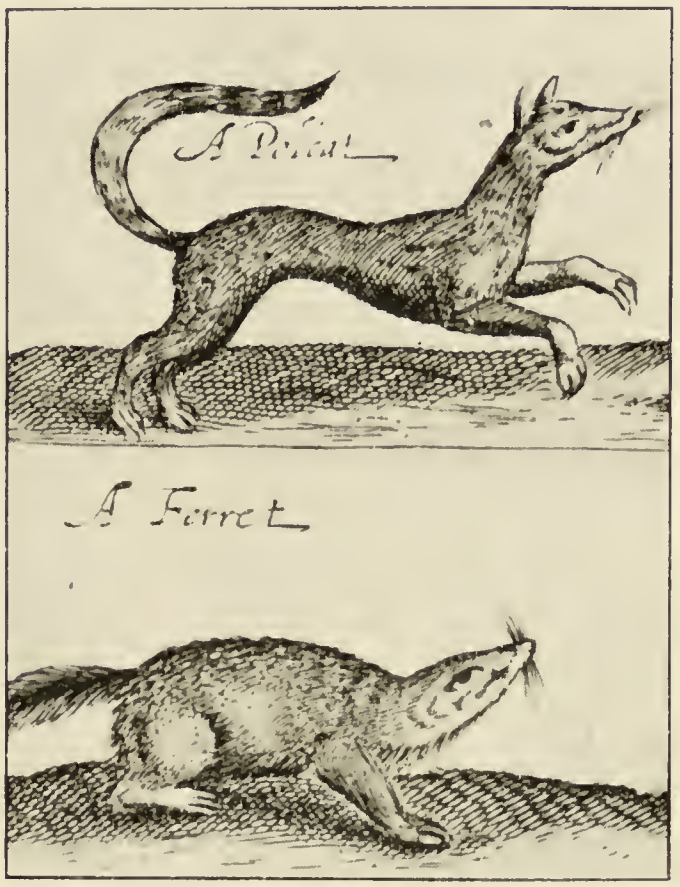
[4] Barclay, "Studies in Rat-catching," London, 1891.

The mongoose (Common Indian Mongoose, *Herpestes mungo*) is often recommended by dealers to people suffering from a rat plague, but owing to the fact that the animal becomes soon tired of a permanent rat menu and learns to appreciate the taste of chickens and ducklings, this remedy is often worse than the disease which it was intended to cure. The disastrous results of the experi-



FROM "A BOOKE OF BEASTS LIVELY DRAWN," 1660.

ment made by some planters in Jamaica are often quoted as illustrating this fact. Introduced into the island to clear the sugar-cane fields of rats, this animal rendered at first excellent services, but soon developed into a worse plague than ever the rats had been by the wholesale destruction of poultry and harmless animals. At the same time the mongoose, by extirpating the ground

ICHNEUMONS, *Herpestes griseus.*

lizard, so increased the swarm of ticks and grass-lice that the Government had finally to take measures for the extermination of the mongooses.

The food of the mongoose is varied. It lives principally upon rats and mice, snakes and lizards. In disposition it is, for its size, decidedly fierce and blood-thirsty, but despite its natural fierceness is easily tamed, and forms a gentle and affectionate pet. The Indian mongoose, like its Egyptian cousin, is valuable as an exterminator of rats, ships having more than once been cleared of these pests in a comparatively short period by the introduction of a mongoose.

Of the two domestic animals used for the destruction of rats, it may be said that both a good rat-terrier and a good cat are worth their weight in gold. The happy possessor of either will rarely see a rat about his premises, and as neither animal will refrain from "trespassing when in pursuit of game," very few rats will ever be found in the neighbourhood of their domicile. An English rat-terrier, "Jack," has been earning golden opinions in Denmark through having, during the first year of the Danish rat war, killed enormous numbers of rats.

Unfortunately, good ratters are very rare. As for the cat, the great majority of these evidently have found, from years of being petted, that it is better to be waited upon than help themselves to a rat or mouse. More than once I have seen a full-grown cat deliberately decline battle with a rat and walk away[5]; so much have

[5] Wood saw a fight between a cat and some rats, in which the former was so severely wounded that it died two days afterwards of its injuries.

the blessings of a luxurious civilization, as represented by the cats'-meat man and the morning milk, tended to make sluggards[6] and cowards of the descendants of those

THE CHAMPION RAT-KILLER OF DENMARK : "JACK," AN ENGLISH "RATTER."

whose courage and industry in killing rats procured for them among the ancient Egyptians the attribute of sacredness.

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[6] During 1907, 15,319 rats were received at the London Institution for Lost Cats, as compared with 13,314 in 1906 (*Times*). The number of rats in London exceeds 6,000,000.

In Arabia the cat is held in high esteem. It is said that the prophet Mahomet one day, when suddenly called away, cut off a piece of his magnificent garment rather than awaken the cat which had fallen asleep on it. To-day Mahometans consider it an act of piety to contribute to the public maintenance of one or two cats.

THE COMMON WILD CAT.

There is to be found in England and France a curious survival of the idea underlying the deification of cats by the ancients, in the fact that in both countries cats are on the establishments of the Civil Service. At the General Post Office in London, for example, there

is a paid staff of cats, whose duty it is to protect "the King's mails" from the rats. In return for their service

WOODEN MUMMY-CASE FOR A CAT.

they are provided, out of the public purse, with free board and lodging.

In France, as in England, cats are used in the Government service, and, like their cousins in this country, are the recipients of an annual grant. They are actually trained for the purpose, and, to fit them for service among military stores, are at first sent on one or two voyages on a man-o'-war. If they prove equal to killing the rats always found in the holds of large ships, they are then promoted to a place on shore.

CAT, RAT, AND MOUSE.
FROM "A BOOKE OF BEASTS LIVELY DRAWN," 1660.

But apart from the fact that the large majority of cats are to-day of little use in keeping down the number of rats, there is another objection to be found in the ease with which cats become wild again.

"There is no doubt," says Romanes, "that domestic cats which indulge either in nocturnal poaching expeditions or which have taken to a completely wild life in the woods, are a terrible pest to game preserves and

rabbit warrens. In the Island of S. Helena, Darwin tells us, a few cats which had been originally turned loose in order to destroy the rats and mice increased in numbers so as to become a perfect plague. The same thing happened in South Africa, where the domestic cats that had run wild became modified into large creatures of exceeding fierceness, inhabiting rocky hills."

BRONZE CASE FOR A MUMMIED CAT.

An old captain once told me that he used nothing but rats to keep his boat clear of rats. "I learned the trick," he said, "when I was mate on one of the boats that carry grain from the Black Sea to London, which is

only another way for saying that you didn't know what you had more of, bushels of corn or rats. Our bo'sun was a Dago, and he used to trap every six months or so a dozen rats, kill the does, and feed them to the bucks

HEAD OF THE CAT-GODDESS BAST.

after first starving them a bit. Perhaps he would repeat this until he had about six or seven strong bucks with a decided liking for rat-flesh. Then he would let them loose. I can tell you, mongoose weren't in it. They

would begin with the nestlings and young rats and clear the ship in no time. But every now and then we would find at intervals one of the bucks dead and partly devoured. I suppose he had been killed in a fight for a doe. And in proportion as they killed or maimed one another in fighting the boat began to fill up again with shore-rats, and Dago would have 'another go' at making 'ratters.' But, at any rate, this plan used to keep us as good as free from rats for six months at a time, and that is a big thing to say of almost any boat, let alone one in this trade."

Dr. Shaw, in his "General Zoology," states that a gentleman who travelled to Mecklenburg about 1830 saw at a post-house a rat with a bell about its neck, which the landlord assured him had frightened away the whole of the "whiskered vermin" which previously infested the place.

At Bangkok, the Siamese capital, says the same writer, the people are in the habit of keeping tame rats which walk about the room, and crawl up the legs of the inmates, who pet them as they would a dog. They are caught young, and, attaining a monstrous size by good feeding, take the place of our cats, and entirely free the house of their own kind.

About the year 1770 England had completely come under the ban of the rat plague, for there is quite a crop of rat literature about that time. In 1768 there appeared "The Complete Rat-Catcher. In which are contained rules for the utter Extirpation of those Mischievous Vermin. By Robert Smith, late of Turnham-

Green, Rat-Catcher to the Princess Amelia, &c., and several of the principal Nobility. London : 1768."

THE

Complete Rat-Catcher.

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Rat-Catcher to the Princeſs Amelia, &c.

And ſeveral of the principal Nobility.

LONDON:

Printed for the Daughters of the late R. SMITH.

AND

Sold by J. BARKER, Ruſſell-Court, Drury-Lane; and S. SMITH, No. 18, Kennington-Green, Lambeth.

(Price One Shilling and Sixpence.)

Where may be had the Traps, &c. as uſual.

N. B. This valuable Treatiſe was ſold by the Author for 10*s.* 6*d.*

This was followed in 1776 by a book by the same author, entitled "The Universal Directory, for taking alive and destroying rats and all other kinds of four-footed and winged vermin in a method hitherto unattempted. Calculated for the use of Gentlemen, the Farmer and the Warrener. By Robert Smith." As Smith charged 10s. 6d. for as much matter as is contained in about two columns of the *Times*, it is not to be wondered at that other rat-catchers should wish to sell their "mysteries and secret charms" to a rat-infested world; hence, we have little pamphlets written by such highly important men as the Rat-catcher to His Majesty's Navy and Victualling Yards, down to plain John Middleton, of Walthamstow, who, it is to be hoped, was more honest as a rat-catcher than as an author; for his book is stolen, preface and all, from his brother-authors' writings.

Rat-catching in these times must have been a profitable occupation. The rat plague being then as yet a new factor, both the authorities and the public appear to have made tremendous efforts to deal with it effectively. Even women seem to have been attracted by the advantages of this profession, for an old warrant, dating from 1672, the time of the black rat in England, proves that at such early date women had commenced to compete with man in the labour market. It says: "Whereas Elizabeth Wickley is employed in killing of Rattes and other Vermins, in and about His Ma'te's stores and houses in ye Tower of London, I have therefore thought fitt to allow her ye sum of Eight Pounds

per annum.—Thomas Chicheley, *Master-General of the Ordnance*." But the want of concerted action makes the

AN OLD RAT-CATCHER.

task a hopeless undertaking, and gradually the public becomes accustomed to the presence of large numbers of

rats, and the damage caused by them: believing that the evil cannot be cured, it settles down to enduring it, like the London fog, while it lasts.

The profession of rat-catcher is an old and universal one. In Italy in the seventeenth century this kind of professor went about with a pole bearing a square flag, on which were representations of rats and mice; a sword by his side, with several dead rats hanging from it, and carrying in one hand a box of poisoned lozenges. In this country there was formerly a State official—the Royal Rat-catcher—who was distinguished by a particular dress, viz., scarlet, embroidered with yellow worsted, on which were figures of rats destroying wheat-sheaves. The *Gentleman's Magazine* for 1741 alludes to Mr. Gower being appointed Rat-killer to His Majesty —"a place of £100 a year, an honourable office." Pennant's "British Zoology" mentions the functionary as existing in 1776; while a pamphlet published in the year 1813, on directions how to kill all sorts of vermin and insects, has a portrait of the Royal Rat-catcher prefixed.[7]

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[7] That the rat-catcher was once a public character of great import cannot be gainsaid, and even his daughter has been immortalized in that fine old ballad, several copies of which are religiously preserved at the British Museum. It relates that

"In Westminster, not long ago,
There lived a Rat-catcher's Daughter;
She was not born in Westminster,
But on the other side of the water,
Her father killed rats
And she cried sprats
All round and over the water,

Of mechanical means there are legions, from the modest penny trap to the most elaborate and ingenious cage-traps worth 10s. to 30s. Generally speaking, the best trap is useless unless it is handled and baited with the utmost care, and in the right hands a small sixpenny trap will catch dozens of rats, and earn its money a hundredfold. The traps used by Dalson, a famous London rat-catcher, are of the most primitive nature, yet never fail to help him to catch a few hundred rats in one night whenever one of his many patrons requires them for "sporting purposes." It must be clear, however, that by the non-expert traps can be usefully employed only where the number of rats is small, and where a decided result is not sought. For the rats are cunning animals, quick to discover the danger that threatens from such contrivances. By means of their smell they recognize those traps that have once before been used successfully, and avoid them most carefully. If, in order to remove such traces of handling, the traps are cleansed in water or steamed, their easy working soon becomes impaired. Apart from this, they are affected by moisture and air,

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And the gentle folks
They all bought sprats
Of the gentle Rat-catcher's Daughter."

But this idyllic state is rudely disturbed, for

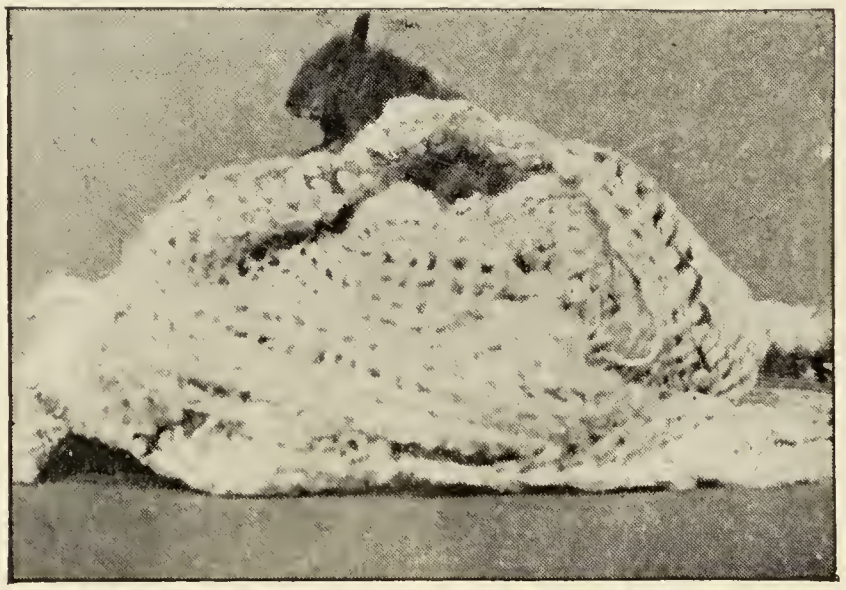
"There was a man who cried lily white sand
In Cupid's net had caught her;"

and this blissfulness so turns her head that she falls into the water, whereupon

"He cut his throat
With a piece of glass
And stabbed his donkey after!"

which oxidize the wire parts, and gradually destroy them. In addition, the trapping of rats—by the layman—is far too tedious a process to have any perceptible influence upon the number of rats, having regard to their prodigious fecundity.

Rat "gins" are still more awkward and slower to use than traps; for as they can only catch one rat it is



MOUSE CAUGHT IN A SHAWL.

necessary to remove the victim before the gin is ready for use once more. If the rat happens to be caught by one leg only it will bite it off and thus make good its escape, though it will be killed immediately on rejoining its companions, as being of no further use to the rat tribe. The effect of such failure in catching will be found to be that no other rat in that district will ever be seen near a "gin" again.

On "how to use traps successfully" the old books give us some valuable hints. In order to attract the rats,

says Robert Smith :[8] "Take twenty drops of the oil of rhodium, six or seven grains of musk, half an oz. of the oil of aniseed, put them in a small phial, and before you set the traps shake them well together ; then take a small piece of paper twisted up, dip it in the bottle and rub each end of the trap, and leave the paper in the trap. The reason of mixing these three ingredients together is that I have always tried it with

"STARVED TO DEATH IN THE MIDST OF PLENTY."
MOUSE IMPRISONED IN AN EGG.

success ; for in some places the rats love the smell of rhodium, in others they like the smell of musk, and again in other places they love the smell of aniseed."

For bait the following recipe is recommended : "Take a lb. of good flour, 3 oz. of treacle, and six drops of the oil of caraway, put them all into a bowl, and be sure to mix them well, then put a lb. of the crumbs of bread to it, for they like the bread mixed with their food better than the food alone."

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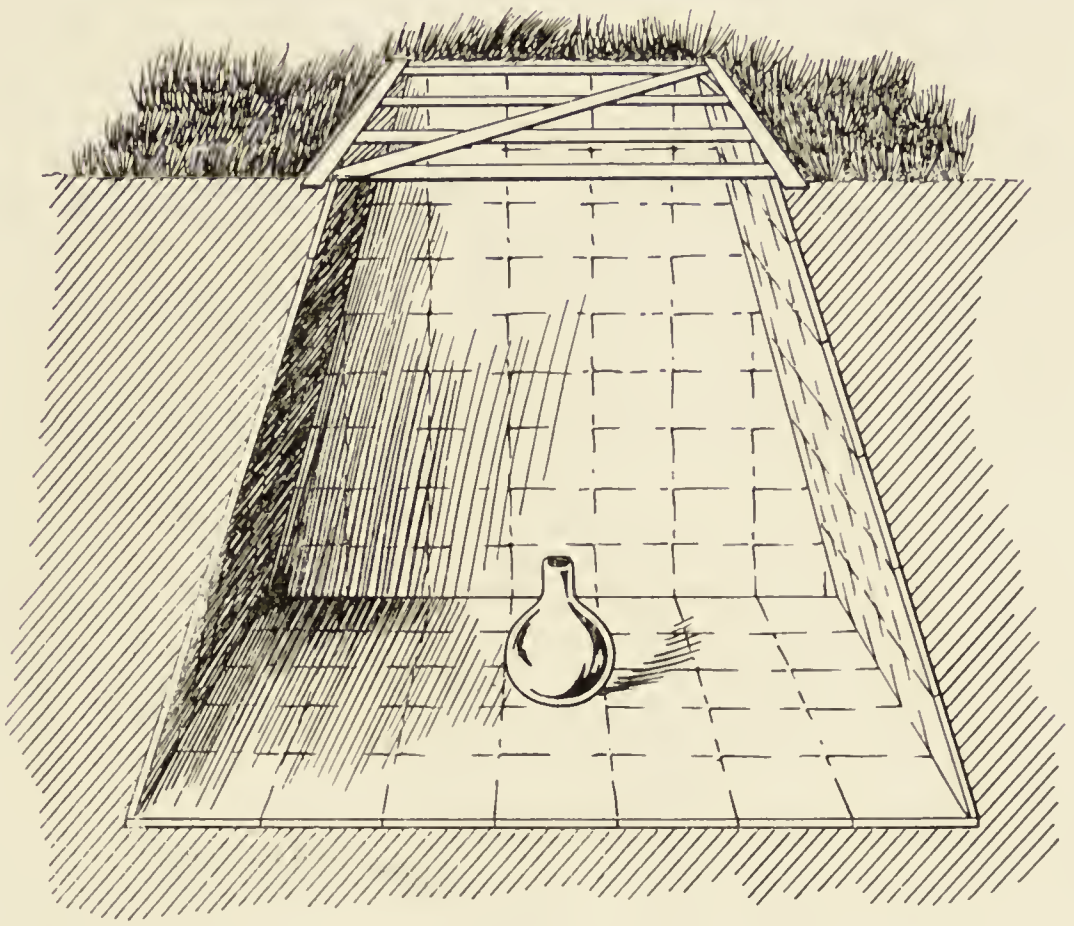
[8] "The Universal Directory," London, 1786.

Smith tells us also what to do when the rats have settled down inside walls and behind wainscoting. "To send them out from behind the wainscot and in the ceiling find out a small hole or crack, then take a handful of common salt and put it in at the hole or crack, and pour upon the salt a spoonful or two of oil of vitriol, and this will make such a fumigation or smoke that they cannot bear it. Do this in two or three places as near where you can hear they are as you can, and it will cause them to forsake those places. This method is very safe, as no damage can possibly ensue to the wainscot from the smoke."

To discover the whereabouts of a dead rat, providing it is warm weather, Smith advises the following: "Take a butterfly net over to the butcher's shop, there catch a dozen blue-bottle flies, and take care not to hurt them, slip them into a glass jar and tie a rag over it. Return to the room where the smell is, and shutting windows and doors, let your pack of flies loose and sit down to watch them, and in half an hour you will find they are all buzzing round one spot. Have this spot opened out, be it wall or floor, and there the dead rat will be found."

The trap which Brehm describes in "Thierleben" "is no credit to the human heart," as he says, "but is most effective." Close to the haunts of the rat dig a pit 5 feet deep, and line the bottom and sides with tiles. The bottom should be larger than the top, and the walls be slanting, so that it is impossible for the rats to climb out. Then pour out honey diluted with water, mixed

with mutton fat and other fragrant stuff, so as to give a coating to the bottom, but no more; put in the

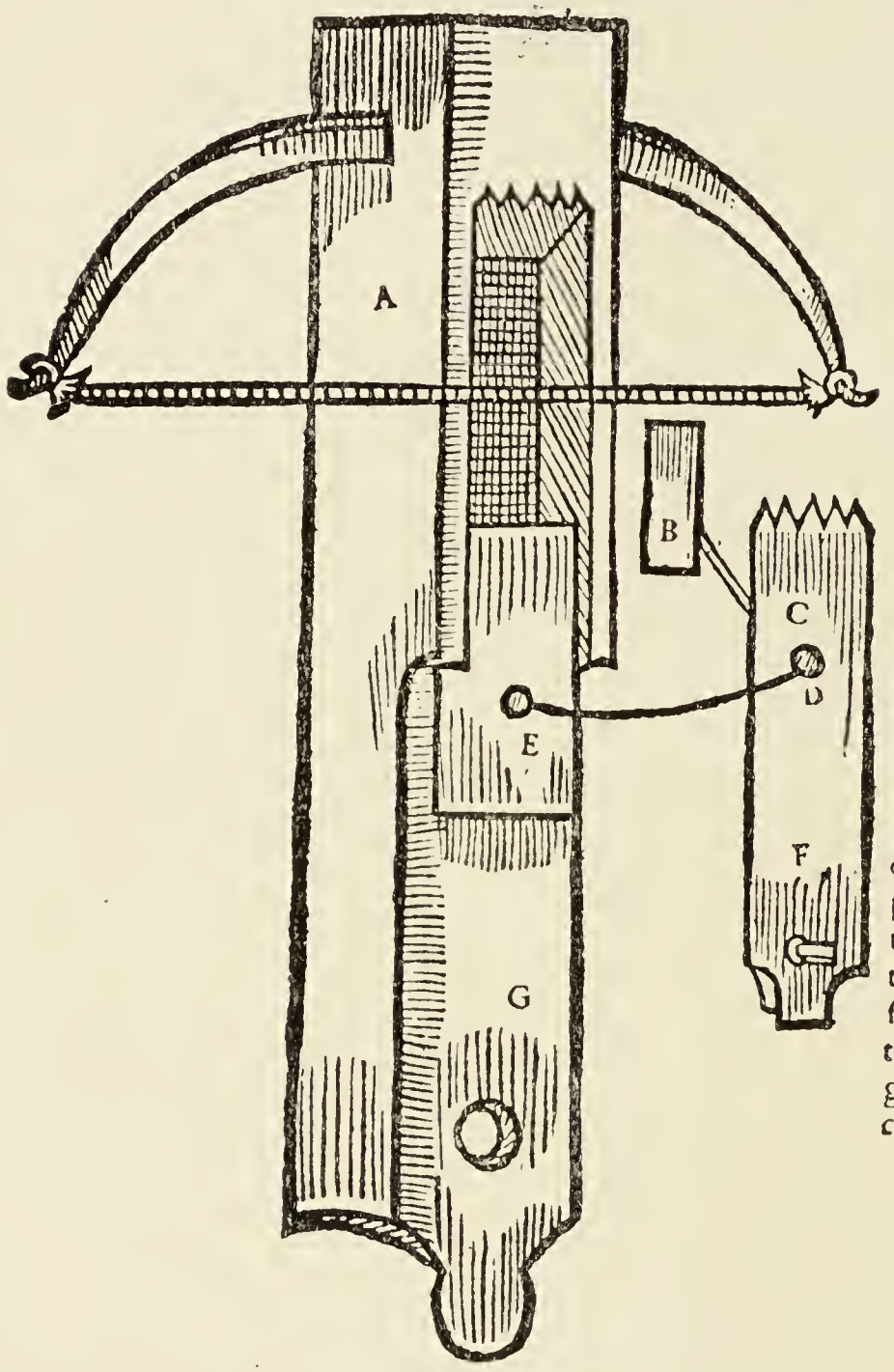


"RAT-PIT."

centre a small earthen vessel with a very narrow neck, filled with a mixture of honey, maize, wheat, hempseed, oats, fried bacon, and similar delicacies; spread a few handfuls of chaff on the floor, put a lattice door on the top so that no chicken or other young domestic animals may tumble into this pit, and then rest in peace, that all your rats will soon be got rid of. The fragrancy of the honey and the cosy-looking chaff will tempt the rats to jump down in joyful expectations. But, alas! though the fragrance is indeed lovely, no one can live on the 'smell' alone, and certainly not rats. They then commence an

Engines and Traps.

The bow trappe for Rats or other Vermine.



a The hole to tie the ſtring of the bridge.

b The clicket
c The lidde.
d The hole to tye the ſtring.

e The hole to put through the ſtring on the ſide.
f The pin for the ſtring.
g The hole to carrie it by.

This engine or trappe with the bow, is made like a bore, of a whole peece of wood, with the lidde opening & ſhutting aboue, and this ſide is vnbent, ſhewing the left ſide and the lidde, and clicket, taken out: with holes and the ſtring for to ſet him, as more plainly ſhall be ſhewed bent and ſet.

FROM PASCALL, "SUNDRIE ENGINES AND TRAPPES," 1600.

orgy of cannibalism. The first rat has tired itself out in trying to escape. Down jumps rat No. 2. Sometimes there are deliberations, but they are cut short by the terrible hunger of No 1. A fight for life and death commences, and the victor devours the vanquished. A few hours after there will be again two captives and another grim duel. The process will go on until all the rats have been caught in the pit. It has the further advantage that though it is a 'murder hole' it remains always fairly clean."

Rat Poisons.

The need for means that would destroy the rats more quickly and over larger areas is apparent. Consequently a large trade in rat poisons has sprung up. They may be bought at any chemist's shop, either in the form of arsenic, strychnine, or phosphor paste, or in the form of various proprietary articles. The solid poisons are generally employed in the form of pills or paste, or are mixed with dripping, bacon, or a similar bait.

Considering the grave danger involved in using such poisons, it must be a matter of surprise to find how large the sale of such preparations still continues to be. The danger is increased by the habits of the rats to carry away bits of food and conceal them in places where afterwards fowls, dogs, pigs, cattle, and even children are reported to have found and eaten them, and died in consequence. A farmer who is personally known to me told me that one day, after having placed out rat poison, he just saved, "by the skin of his teeth," as he expressed it, his little son from eating a piece of bacon which the

child had found in the bedroom, where it had been carried by the rats.

The replies given to the question on this point in the schedule sent out by The Incorporated Society for the Destruction of Vermin are further evidence of the extreme danger attached to the use of poisons. In one case a large number of cats were killed, "nearly all the cats in the neighbourhood," as the informant put it. In others valuable dogs and pedigree fowl were killed. Another man lost nearly all his pigeons ; and there are dozens of cases of pigs having died from poisoning. Several cases are on record of farm labourers and cottagers having used threepennyworth of rat poison, and finding a pig dead next morning, but noticing little decrease in the number of rats.

Whilst seemingly cheap, the use of ordinary rat poisons is actually the most expensive mode of rat destruction that may be chosen, and that quite apart from the loss, which has always to be reckoned with, of other life than that of rats. I know of two cases where several pounds' worth of poisons were used, in one with only transient results, in the other with almost no results. This fact finds its explanation in the exceedingly fine instinct of the rats, which will not touch food or drink new to them as soon as they have observed that one or more of their tribe have died after partaking of such food or drink. Experiments which I have made with rats seem to prove that they can tell whether a rat has been killed with a mineral poison such as arsenic, strychnine, or phosphorus. Though kept without other food

for three days, the rats would not touch the corpses of poisoned rats, though they would greedily devour rats that had been killed with bacteriological preparations such as Danysz' virus or ratin.

Dr. Raebiger[9], who made a series of experiments on behalf of the Brandenburg Chamber of Agriculture (afterwards adopted by the Prussian Government), stated with regard to vegetable poisons, of which it is claimed that they are only fatal to rats, "that neither the vine-leek nor the sea-onion produce satisfactory results. The sea-onion contains chiefly scillitoxin, which is fatal to dogs, whilst both are notoriously bad baits." "Further," says Raebiger, "if rats have once smelled the corpse of a rat dead from eating vine-leek they do not only avoid this vegetable poison themselves most carefully, but are able to warn in a mysterious way subsequent generations against the danger of eating this stuff. As the result of my experiments during the last six years with such means I have come to the conclusion that preparations which are really non-poisonous are unable to kill rats, and poisons, call them what you like, if they kill rats will also kill domestic animals. In other words, there is no poison[10] in existence which will only kill rats."

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[9] Dr. Raebiger, "Masznahmen zur Bekämpfung der Ratten, Mäuse u. Schneckenplage," Berlin, 1907.

[10] Bacteriological preparations used for the destruction of rats cannot properly be called poisons. They kill by causing a disease in the animals that have been inoculated with them. Some of these preparations are known to be harmless to animals other than rats and mice, others have been known to infect domestic animals and human beings. See p. 132.

"The principal objections," says Fletcher Barrett, "to the destruction of vermin by means of vegetable and mineral poisons are that the use of these substances is dangerous to human beings and domestic animals like dogs and poultry, and that the vermin, after partaking of the poisonous substances, retire to inaccessible haunts to die, their bodies then decomposing and becoming a danger to the health of the community.

"Various expedients have been adopted to overcome the latter unpleasantness, and it has been thought that if barium carbonate be mixed with a sufficiency of the poison decomposition would be so retarded that it would not become an active nuisance. For this reason nearly all the rat poisons at present sold contain a varying proportion of this chemical.

"The poisons most used for killing rats and mice are strychnine, arsenic, phosphorus, squills (sea-onion) and cantharides. The first two of these are mixed in various proportions with sugar and powdered biscuit, oatmeal, flour or rice flour, flavoured with the essential oils of rhodium, aniseed or caraway, and coloured with either Prussian blue, soot, or chrome green, the last preferably, as this colour is the most easily detected if the rat poison be used for criminal purposes. If used in powder form, it is advisable to bait the ground with the inert base for a few nights previous to putting down the poison, in order that the vermin may become accustomed to the flavour of the substance used.

"If a paste preparation is wanted it can be prepared by mixing the powder with a sufficiency of beef dripping.

Phosphorus is generally administered in paste form, this being made with a fat base, such as lard, in which the phosphorus has been dissolved.

"With a poison containing strychnine as the active ingredient, mice, as a rule, die on the spot, but rats die in their holes, whilst death from arsenical poisoning is somewhat slower. Powdered squill is not much used in this country, but as it is an active heart poison to rats and mice there is great scope for experiments in this direction. Cantharides or Spanish fly is still less used. It produces inflammation and lesions of the kidneys, together with peritonitis, and is very active, but its use in unprincipled hands for illegal and undesirable purposes renders it necessary that the most stringent regulations shall govern the sale of it, and therefore, rightly, it can only be procured with difficulty."

Quaint and Queer Methods.

The objection to the means mentioned so far suggested to some ingenious people the idea of driving the rats away by making a terrible noise in their haunts or by pouring into their holes evil-smelling substances. A big noise may drive the rats away, but only for a short time. If repeated frequently, rats will become used to it and take no further notice. Evil-smelling substances will even, under the most favourable circumstances, only provide a temporary cure. Dr. Raebiger experimented with saprol for that purpose on a heavily infested estate, and obtained no results whatever.

I am aware of only one case where this remedy has

been successful. One day, when examining a certain stretch of the London sewers with the view to ascertaining the degree of rat-infestation, I was struck by the total absence of rats and even rat dejecta throughout the sewers underneath Soho. Mr. Berry, the main drainage superintendent of the London County Council, gave as a reason for this remarkable fact the growth of the motor industry in that quarter. He said that a good deal of petrol finds its way down the gratings, and as in evaporating it forms a heavy gas which lies close on the water, no rat or any other living thing can exist there. As to the rest of the London County Council main sewers, I am bound to say that they compare most favourably for cleanliness and good air with some kitchens, pantries and cellars of several restaurants I have seen. In one kitchen alone, not 100 yards from Piccadilly Circus, I have seen at least a hundred times more rat dejecta, both old and fresh, than during two hours walk in the main sewers below.

But even if a noise could be made strong enough, and a substance be found evil-smelling enough to drive the rats permanently away, it is not at all in the public interest to get rid of the plague in one place and thus make it all the more intolerable in another.[11]

The sewers in Paris are well known to be infested with rats, but the authorities adopt a neat and extremely humane way of reducing the numbers: In places where

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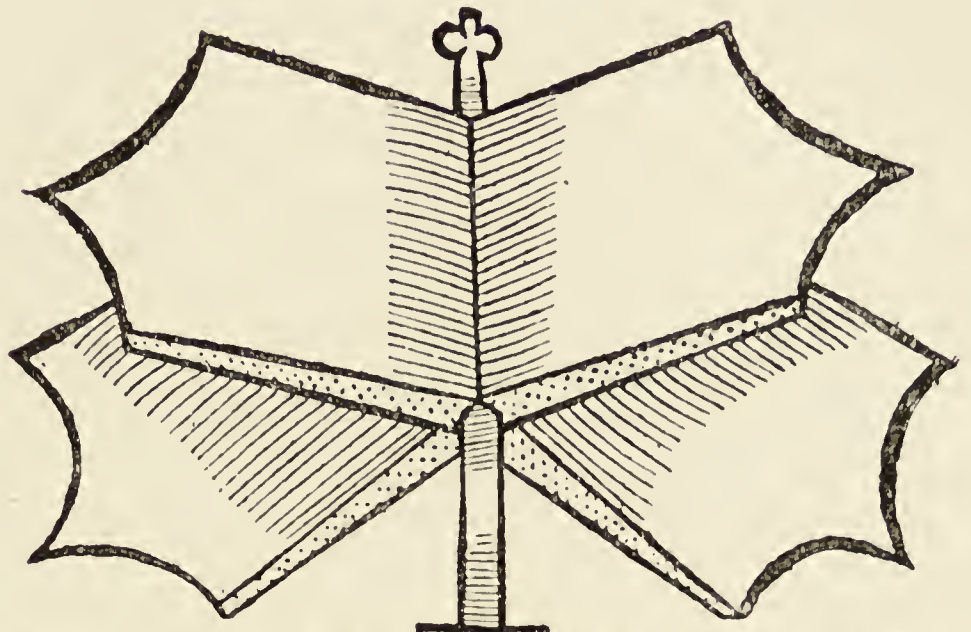
[11] The same objection applies to the remedy of pounding the common dog's-tongue, when gathered in full sap, and laying it in their haunts.

the rats are found, an electric wire is laid just an inch or two high, to be reached by an animal standing on

A Mill to take Mice.



THis engine or Mill, is made of y. thin boards, and thicker in the midst, then at the ends. The one halfe of the bredth is set in a joyned within the other halfe, and boared with a per- cer thorough the midst, and there is put thorow a great wyar, or a smal pinne of wood, as yée may sée, and that pinne is put into a thicke bord of four inch bord, which borde lyeth on some ta- ble or other borde from the ground halfe a yeard, or as yée shall thinke good: and set some panne or pot with water under your mill, and baite your mill on both sides of each leafe with some butter, mixt with otmele and sugar, and set all other things away, and so shall ye drowne therein or more perhaps in a night, as I haue séene done, if there be store. Ye shall make your mill to turne very easely, that the least weight thereon shall turne it. Also set your Mill an inch from your square borde that the pinne is in, and baite your borde with some otmeale, to tice them to the mill.

FROM PASCALL, "SUNDRIE ENGINES AND TRAPPES TO TAKE POLCATS, BUZARDS AND RATS," 1600.

all fours. Tempting delicacies are placed at frequent intervals, and directly a rat raises itself and rests a paw upon the wire with the intention of getting at the food, it is electrocuted and there is an end of it.[12]

The proprietor of a restaurant in Oxford Street to whom I recommended the following measure, found in an old book, told me afterwards that he freed his place entirely from rats. "Take a pint of common tar, half an ounce of pearl ashes, an ounce of oil of vitriol, and a good handful of common salt. Mix them all together in any old pan, get some pieces of paper and put some of the above mixture very thick on the paper and place enough of this into the holes sufficient to stop them. Now by stopping the holes with the above mixture I have kept a gentleman's house entirely clear and never have caught one single rat."

In his "Cries of London," John Smith says that early in the last century the Norwegians employed the following device: They singed the hair of a rat over the fire and then let it loose; the smell was so offensive to his comrades that they quitted the house and were eventually destroyed by combating with other broods.

Old Zedler, in his "Universal Lexicon," devotes a great deal of space to the rat problem. Among other means he recommends to "put tar in and around rat holes. When that has been done the rats go away and do not come back, for when the tar sticks to their feet they will not suffer it, but sooner bite off their feet."

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[12] Walter Raymond, "Some Ingenuities of Rat-catching."

He also advises to "burn the hoof or horn of a mule. The smell is so detested by the rats that they will go away and never come back."[13]

"Plaster of Paris (dried calcium sulphate) mixed with sugar and flavoured has long been used as a rat poison, the *modus operandi* being to place the mixture in accessible places and near thereto to place bowls of water, the theory being that the rats will eat freely of the mixture, which creates an intense thirst, and then drink of the water. The calcium sulphate is thereby hydrated, and, setting hard in the interior of the rat, literally "stiffens him." It seems an unnecessarily cruel method of killing but fortunately for the rat in this instance theories do not invariably work out in practice." (Fletcher Barrett.)

A method at one time much in vogue in Germany and the United States was to fry small pieces of bath-sponge or cork in bacon fat and let the rats eat it. This, in common with the English method of using plaster of Paris, is a cheap and fairly effective remedy; but, as the three methods inflict a terrible amount of pain, it is to be desired that they are not employed. Even a rat is entitled to a sharp and short execution.

In Wales, Cornwall, and in Staffordshire I have

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[13] "Beräuchere dein Haus mit der lincken Klaue eines Maultieres, so bleibt keine Ratte darinnen" (Zedler, "Universal Lexicon," Leipzig, 1741). He also suggests the following horrible methods: "Auch so maneine oder mehr Ratten lebendigen Leibes verbrennet, und einen Rauch davon macht, sollen sich die anderen Rattenleigcher Gestalt verlaufen."

found people who firmly believed that the best way to get rid of rats was to "cast a spell over them." That rats in a pasture could be extirpated by anathematizing them in rhyming verse or by metrical charms was once a prevalent belief in this country. Thus Ben Jonson says: "Rhyme them to death as they would Irish rats," and Shakespeare makes Rosalind say in "As You Like It": "I was never so berhymed since I was an Irish rat."

"Not so very long ago," said a writer on "Rat Exorcism" in the *County Gentleman*, "many curious ideas were entertained respecting rats in the Western Isles of Scotland. Some of the older inhabitants there can still remember when it was firmly believed that where rats abounded they could only be expelled by incantation. To be effectual this had to be delivered in rhyming form, composed and adapted to suit the particular occasion and circumstances. Attempts to kill down the rodents by any other means proved worse than useless, for so incensed did the survivors become that they redoubled their efforts in all sorts of mischief on the premises where their comrades were done to death. Enchantment was, therefore, held to be the only remedy."

"A rat-expelling incantation is in Gaelic termed an *avir*, and is, literally, a satire consisting of threats, expostulation, and cajolery. In the distant past the island of Lismore was so overrun with rats that an incantation was levelled against them. This was so successful that the whole of the rats left the island, and swam in solid phalanx across the ferry to the opposite mainland of Appin. The exorcism which proved so efficacious has

been preserved, and the following is said to be a fairly literal translation from the original Gaelic :—

"A thousand ills befall thee, greedy rat !
Expertest thief that ever yet was born !
In barn and stackyard, maugre trap and cat,
Sad is the state of all my stock of corn ;
Nor does a handful serve thee ; shameless thief,
Unblushing rogue, thou claimest the whole sheaf !

My barley thou hast millered into meal.
Chaff and small dust together close commingled ;
Thou spoilest more than ever thou canst steal ;
Hadst thou but any shame thine ears had long since tingled ;
I wish I had thy head upon a stithy,
I'd rap it with the biggest hammer in the smithy.

Nor corn in sheaf, nor barley snugly stacked.
Could serve thy turn ; but all my garnered grain,
In well-filled sacks, is next by thee attacked.
And all is spoiled, thou thief of fertile brain ;
And all my sacks are nibbled too, and holed—
A sight most aggravating to behold.

Alas ! for all my seed corn in the spring !
Alas ! for all thy keep, my good brown mare !
But take advice, and leave me, rat ; and take
All thy companions with thee : else beware !
My malison shall fall withouten fail
On thee and thine, from whisker tip to tail.

So, rat, be warned, away ! across the ferry,
And in some quarter else be sleek and merry ;
By good St. Michael, and by chaste St. Bride,
I charge thee, leave me ere the morning tide !"

Quaint old Zedler states in his "Universal Lexikon" that no rat is found in the monastery of Augsburg, and that the soil from that place sprinkled anywhere will always banish the rats. "No one has yet been able to explain this fact except that the monastery itself ascribes

the virtue of the soil to the devoted prayers of the holy Ulrich, who died there in 973. In the fifteenth *sæculum* A.D., a Polish prince, Radzivil, had been driven away from his palace by the great number of rats. Hearing of the virtue of the soil, he went there and obtained some of the soil from the tomb of St. Ulrich" (probably to make doubly sure of the result). "Certain it is that when he brought the soil into the palace all the rats became invisible."

In the twelfth century, the peninsula of Jumièges was overrun with rats. The people invoked St. Valentine (once Bishop of Terni), and the saint drove the whole of the vermin into the river Seine. Visitors are still shown the spot where the rats ran into the river. The run is called "The Rats' Run," and the spot shown is known as "Le Trou des Rats." (Brewer, "Dictionary of Miracles.")

Crooke, who mentions in his book, "Popular Religions and Folk-lore of Northern India," that "the rat is sacred to Ganesa, the elephant-headed god, and that to kill a rat is considered a great crime," says that "when rats are troublesome in a house the women of the family vow to give them sweet-balls on a certain day if they will cease from troubling."

Rat (and Sparrow) Clubs.

In proportion as the number of rats grew, farmers here and there perceived the futility of waging war against the rat single-handed and without an attempt

at concerted action; they banded themselves therefore together in clubs, the sparrow being also proscribed because it is regarded by many as the "rat of the air."

Such clubs carry on the killing of rats (and sparrows) competitively, members sharing at the end of the year *pro rata* their "bags" in the money prizes which have been contributed by members' subscriptions, and by donations from the squire, the parson, the doctor and the publican. As the killing is done co-operatively, it follows that a great number of rats must be destroyed within the same area and period, that the damage done by them must be proportionately reduced, and that such systematic efforts made persistently must eventually result in putting an end to the rat plague. That is, in fact, what does happen locally, and for a short time. But no sooner has parish A succeeded in getting the rat plague well under control, than all its efforts are rendered futile by an immigration of rats from the neighbouring parishes B, C, and D, where no such clubs exist, where therefore the rats are fruitful and multiply, and whence the surplus of the rat population will emigrate at regular intervals to fresh woods and pastures new.

It is with experiences of that kind before me that I advocated[14] the reorganization of the existing Rat (and Sparrow) Clubs, and the formation of similar Rat Clubs in every parish as a practical scheme for reducing to some extent the incredible damage done by these pests, and as

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[14] "A World's War against the Rat," *Daily Mail*, October, 1907, and "The War on Rats," *Daily Mail*, January 10, 1908.

a preliminary step to the passing of the Rat Act promoted by the Incorporated Society for the Destruction of Vermin. It is proposed to effect this by means of a National Rat-Killing Competition,[15] under which £300 are offered in money prizes.

All old and new Rat Clubs shall be eligible for membership, but of the existing Rat and Sparrow Clubs only those operating in districts where the sparrow is proved to the satisfaction of the Incorporated Society for the Destruction of Vermin to have become a pest.[16]

All Clubs will be asked to adopt the model rules, based upon those prepared by the Board of Agriculture.

Bacteriological Preparations.

An effective means of rat destruction over large areas should possess the following qualities:—It should be (1) a good bait; (2) fatal only to rats and other mouse-like rodents, but harmless to other animals; (3) capable of affecting the whole community of rats present within the area to be treated; (4) easy to use; (5) cheap.

How do the various bacterial preparations answer these requirements?

A bacterium, it will be known, is an extremely

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[15] Particulars of this National Competition may be obtained at the offices of the Incorporated Society for the Destruction of Vermin, 95, Wigmore Street, Cavendish Square, London, W.

[16] Proper safeguards will also be made for preventing the killing of other small birds. See Moore, "Rat and Sparrow Clubs," *Journal of the Incorporated Society for the Destruction of Vermin*, I., October, 1908.

minute plant, consisting of only one cell, possessing no chlorophyll (the green colouring matter of plants), and dividing by fission. They are present on most of the objects about us. They occur on the skin of men and other animals, as well as in the mouth, stomach, intestines, and on most of the surfaces of the body that open to the external world. They are found in the water of rivers and lakes, and in the ocean. They appear in the soil down to a depth of several feet. They float in the air, except at high altitudes and over the ocean. It has been humorously suggested that the imps that escaped from Pandora's box were in reality bacteria. But the vast majority of them are entirely harmless as far as we are concerned, and others again are most beneficial. Indeed, were it not for the putrefactive and nitrifying bacteria the dead bodies of plants and animals would lie practically unchanged where they fell, and the fertilization of the soil necessary for life of most plants, by means of substances derived from such dead material, would cease. A number of industries could not be carried on if it were not for the bacteria, and in some, as for instance in the manufacture of cream and in gardening, bacteria are literally made to work for man's benefit.[17]

To this class belong the microbes that have recently been applied to the destruction of rats. Microbes, like other plants, wish to live and grow. Having found a suitable soil and favourable conditions, they will increase at an incredible rate, extracting food from the soil which

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[17] Williams, "Manual of Bacteriology," London, 1907.

they separate into nourishment for themselves, and waste matter which is discharged in the usual way. This waste matter—from the microbe's point of view—is sometimes beneficial to man and animals (as in the industries mentioned before), but sometimes harmful when the matter excreted by the bacteria acts as a poison upon the tissues of the body in which it lives and grows. Owing to the difference in these bacterial poisons, different symptoms are produced which we call by different names: tuberculosis, anthrax, pneumonia, typhus, etcetera ; in other words, diseases which we call by these names are produced by the bacillus of tuberculosis, anthrax, pneumonia, typhus, etcetera. So far as we know at present, each bacillus can only produce one well-defined disease, and no amount of bacilli of tuberculosis inoculated into a healthy body could produce, say, anthrax.

When we enquire further into the nature of pathogenic—disease-producing—microbes, we notice a further specialization of work, if one may so call it. There are certain bacteria that will only thrive on certain specific soils. Thus the bacillus of swine fever cannot be made to grow on a dog or a farm labourer, for instance. In other words, no dog or farm labourer has ever been known to die from swine fever ; or, as the text-books say, swine fever bacillus is a bacillus pathogenic to pigs.

In 1890, Professor Loeffler, of Greifswald, succeeded, during an epidemic that raged among the mice kept in his laboratory, in determining as the cause of this mortality,

a bacillus which he called *Bacillus typhi murium* (Loeffler). It was found that rats, rabbits, guinea-pigs, dogs, cats, birds, domestic animals and man were absolutely immune against infection *per os*, whilst the mortality among mice was enormous, owing to their habit of "nibbling" at the dead bodies of other mice.

During a plague of mice in Thessaly Loeffler used this bacillus with excellent results, and since then similar successes have been reported by Professor Kornauth, John, Schmidt, Dr. Raebiger, and others.

Other investigators now began experiments with the view to the discovery of a bacillus pathogenic to rats, and at different times Danyzs, Issatschenko, Wiener, Schelling, Tartakowski, Dunbar and Neumann described the results of their investigations. Of these, only the discoveries of Issatschenko, Danyzs, and Neumann, claim special consideration.

Issatschenko's bacillus has been largely used in Russia. Raebiger, who experimented with it, reports that he procured some bouillon cultures from the Russian Ministry of Agriculture, and made a series of feeding experiments with white and grey rats. The tests showed that, whilst the results were at first satisfactory, the virulence of the cultures lessened as the bacillus passed through successive generations of rats, until it was entirely lost. After the tenth passage it was found impossible to infect white rats by peritoneal inoculation. Reports from Russia show that in practical tests made with fresh cultures about 70 per cent. of the users obtain satisfactory results.

In the spring of 1900 Danysz described a new method for the destruction of rats by means of cultures of a certain bacillus discovered by him. He obtained it from a spontaneous epidemic amongst harvest mice. By means of rather complicated and artificial methods he managed to increase the virulence of the bacillus to such degree that it became pathogenic for several species of rats. The claim is made that the employment of the cultures of this bacillus, sold under the name of Danyzs Virus, is efficient for the destruction of these rodents. The great hopes raised by the publication of this discovery in the *Annales de l'Institut Pasteur*, April, 1900, *Public Health Reports* of May 25, 1900, Washington, and the *British Medical Journal* were, however, not realized, and the investigations of Raebiger, Simpson, Bahr, and Rosenau tended to show that the claims put forward on behalf of this preparation have been greatly exaggerated.

Rosenau, in his report to the Government of the United States of America sums up the result of his investigations in the following words :—[18]

"The substance known as Danysz' Virus consists of a culture of a bacillus belonging to the paracolon group. It appears to be identical with the *Bacillus typhi murium* (Loeffler).

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[18] "An Investigation of a Pathogenic Microbe, *B. typhi murium*, Danysz, applied to the Destruction of Rats." By M. Rosenau, Director of the Hygienic Laboratory, United States Marine Hospital Service, Washington, 1901.

"This organism is naturally pathogenic for mice, in which rodents it sometimes produces spontaneous epizootics. Its virulence has been raised and specialized by artificial means in the laboratory, so that it has become fatal for rats by ingestion. This artificial virulence is not very stable. It may be maintained under special conditions for a few months, but the virulence is apt to fall off, especially on exposure to the air.

"As far as the rats are concerned, the effect depends somewhat on the amount ingested. Large amounts are frankly fatal. Small quantities are uncertain. Rats that survive the infection of the virus are rendered immune. Such rats may eat large amounts of the virulent virus with impunity.

"The infection caused in rats eating the virus has feeble powers of propagating itself from rat to rat. It therefore cannot produce a widespread epizootic among these rodents. In practical use it must be spread around so that as many as the rats as possible will eat it.

"In many respects it resembles a chemical poison, with this advantage, that it is harmless, in so far as known, to man and domestic animals. It has the great disadvantage that chemicals do not possess, of rendering the animals immune by the ingestion of amounts that are insufficient to kill, or by the ingestion of cultures that have lost a little of their virulence.

"In my experiments I succeeded in killing less than half the number of rats fed on it—46 out of 115. The conditions in a cage are so much more favourable for the fatal action of the virus than could possibly be the case

in nature that it is safe to assert that a less number would succumb in the wild state.

"The virus may, therefore, be used as one of the means in the fight against rats, but it is far from being a sure means of exterminating these rodents in a particular place."

Neumann's Bacillus.

This bacillus was discovered in 1903 by Neumann, of Aalborg. Bahr relates that Neumann found the bacillus in the urine of a two-year-old child which suffered from cystitis, but recovered completely. Being discovered at the precise psychological moment, at the height of Zuschlag's agitation for the passing of his Rat Law, the announcement of the finding of a microbe claimed to be more powerful than any that had been discovered before created the profoundest interest, not only in Denmark and the rest of Scandinavia, but also in Germany and other countries. Professor Kolle in Berne, and afterwards Hess, of the same place, investigators in Russia, Switzerland, Holland, and elsewhere, all corroborated Neumann's statement to the effect that more than 99 per cent. of the laboratory tests had been successful, the bacillus having only in 0·65 per cent. refused to act.

Like other bacteriological preparations, cultures of Neumann's bacillus (ratin) are an excellent bait, being readily and even greedily eaten by the various species of rats and mice.

In order to ascertain whether or not this bacillus is harmless to other animals, a series of independent

experiments were undertaken at the Imperial Institute for Experimental Medicine in St. Petersburg, at the Agricultural Institute at Alnarp, Sweden, by Bahr and Claudius in Copenhagen, the Hygienic Institute in Rotterdam, and by Dr. Raebiger, on behalf of the Chamber of Agriculture in Halle. All experiments yielded uniform results: none of the animals died although they had been given—in most cases forced to ingest—larger quantities of ratin than they would have been likely to eat accidentally.

The following is Dr. Raebiger's report :—[19]

"In order to prove whether or not ratin is harmless to domestic animals, the following experiments were undertaken :—

"*First Experiment.*

1 horse	...	...	received	50 to 60	grs. ratin
1 St. Bernard dog	...	,,	,,	,,	,,
1 fox terrier	...	,,	,,	,,	,,
2 goats, each	...	,,	,,	,,	,,
2 sheep ,,	...	,,	,,	,,	,,
2 fowls ,,	...	,,	,,	,,	,,
2 pigeons, each	...	,,	,,	,,	,,

"*Second Experiment.*

"No symptoms of illness appearing in any one of these animals, each animal, with the exception of the horse, which was required for another experiment, received 100 to 120 grs. ratin.

"No symptoms of illness being detected during several

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[19] Reprinted from the *Journal of the German Agricultural Society* (June 6, 1906).

weeks following the administering of this preparation, it was concluded that ratin, in the quantities in which it is likely to be used for practical purposes, must be regarded as entirely harmless to domestic animals.

"In order to demonstrate the efficacy of ratin for practical purposes, experiments were instituted on seven different estates. The results showed that experiments No. 2 to 7 were very successful, whilst No. 1. was a failure.

"Summing up the results of these experiments we find that :—

"(1) Ratin, when applied in solid or liquid cultures, produces among rats an epidemic, having a very high mortality, often reaching 100 per cent., and that in cases where ordinary poisons are useless. The cultures are eaten readily by rats and mice, are applied without difficulty, and are harmless to domestic animals.

"(2) In certain isolated, circumscribed localities, ratin produces no results."

One of the advantages of this culture over other bacterial preparations is the form in which it is offered for sale. When the Danish Government were making experiments with Danysz' virus and other gelatine cultures, with the view to ascertaining whether science could provide them with a powerful weapon to be employed in the war against rats upon which they were about to embark, many complaints were heard against the impractical manner in which Danysz' virus is supplied. No sooner, therefore, had Neumann's bacillus been discovered when the practical Danish minds set

to work to find a way of supplying the preparation in such a form that it might be applied with ease by any farm labourer. It is therefore to-day supplied in tins. These are opened with a key supplied with every tin, the contents are taken out in spoonfuls, wrapped in pieces of paper, and these baits are placed about the runs of rats. Apart from the saving of time and labour made possible by this form of supplying rat-killing bacteria, it must undoubtedly be one reason why Neumann's bacillus produces better results than Danysz' virus and other gelatine cultures. To me there can be no doubt that the cause of the large percentage of failures observed in experiments made with Danysz' virus is the tedious and difficult process of preparing the cultures until they are ready to be made into bait. It is obvious that from the moment when the cultures are taken out of the test-tubes, touched with fingers, sticks, or spoons, mixed in bowls with water and crushed oats or similar stuff, and kneaded into a dough, the bacillus is exposed to so many dangers that the great majority will have been killed by the effect of light, or by other bacteria, by the time that they have been put out, in the bait, to do their appointed work.

The cost of using Neumann's bacillus ratin compares favourably with that of less efficient similar preparations, though it is higher than the initial cost of rat poisons such as arsenic and others.[20]

As to whether the disease set up by Neumann's

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[20] See page 119 ff.

bacillus is transmitted from rat to rat, Dr. Raebiger thinks that if ratin is applied in due proportion to the extent of the rat plague existing, it will exterminate the whole rat community present in the area under the treatment. According to him, the disease is so transmitted by the parents to the young rats still in the nest. In my opinion no sufficient evidence has so far been obtained showing that the disease has in any case been transmitted from sick rat to healthy rat.[21]

Simultaneously with the reports of the excellent results obtained by many investigators with ratin came two reports of failure—one from an estate in Germany, the other from a laboratory. It appears that in both places the rats had shown an absolute immunity against infection, probably produced by previous insufficient infection by some other virus. Bahr, of Copenhagen, at once commenced experiments with the view to either increasing the virulence of Neumann's bacillus, or to discover some other means of killing immune rats, and yet being harmless to other animals. Such preparation has now been supplied by the Ratin Laboratory in Copenhagen for a considerable time, and the reports to hand show that its average case mortality in practice is about 97.

In Denmark, as I have mentioned before, ratin has become the State remedy, nearly the whole of the State

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[21] The whole subject has been fully dealt with in my monograph, "An Investigation of the Bacilli applied to the Destruction of Rats, Mice, and Voles." London, 1908.

grant of £1,600 per year being expended either on applying ratin on public property or supplying the preparation to those authorities in districts so heavily infested by rats as to make energetic measures necessary beyond those authorized by the Rat Law. In Germany ratin is used by the Government in the endeavour to stamp out or prevent epidemics of trichinosis by the wholesale destruction of rats; and many of the sanitary authorities compel the ratepayers to use it at stated intervals, supplying it usually free of charge. In Great Britain there have been made several tests, on a large scale, by Chambers of Agriculture, Municipal Authorities, and County Councils. The most interesting and important experiment appears to have been on the island of Lesser Cumbræ.

This island covers about 900 acres, and is situated at the mouth of the Clyde. It rises 409 ft., and has a lighthouse. It is stated that a hundred years ago the island was inhabited by about seventy families, who made their living partly as pilots and partly as scouts, but the only remains of their dwellings is the old inn which is now used as a sort of barn. Rats have been on the island for a number of years, but only during the last four years have they become a plague; for about that time the French steamer "Isabella" was wrecked off the coast, the rats swam ashore, and have multiplied at a tremendous rate.[22]

The island is held on lease by Mr. E. S. Parker, of

[22] *Chambers's Journal*, May 15, 1908.

Liverpool, a well-known Demerara sugar planter, to whom I am indebted for the details of this rat campaign. He holds the island purely as a sporting estate, rabbit and woodcock being the principal shooting. The island is very hilly, is covered in the summer-time with large ferns, and is a mass of bloom. The rats, of course, found plenty of food, and the keeper reported last year (1907) that he lost 5 tons of turnips ; at Christmas the rats attacked a 20-lb. turkey, killed it and completely devoured it, leaving nothing but the bare bones ; they have also levied tribute on the rabbits. Rose bushes, wild duck nests, mangolds, were in a constant state of struggle for life against the depredations of the rats. When Mr. Parker saw that the rabbits and woodcocks were going under, he took a hand in the fight by determining to apply ratin. The result has been the total extermination of rats.

On the claim made on behalf of ratin, as compared with the highly sensitive Danysz' virus, that it will remain, at any rate for six months, almost completely unaffected by the heat of India or the cold of Siberia, the Medical Officer of Health of Khargpur reported to the President of Khargpur Station Committee :—

"I have made a careful test of the poison for rats, named 'ratin,' that you sent me. I used one tin at a time, and made up the contents into boluses as directed by the patentee. I give you a list of the results obtained on each day. You will see by this that the amount of ratin eaten was a small proportion of that laid down, one-fourth on an average, due, I think, to the fact that

the test was carried out in the rain, when it is very damp, and as the boluses got sodden they were not touched, and also to the fact that the rats were not hungry, the baits being chiefly placed in the market, in the goods shed, where rats were most abundant and where they could get ample food. I experimented with six rats, which I caught and fed with ratin ; they all died within twenty-four hours, some in twelve hours, so that there was no doubt about the efficiency of the poison.

"The point claimed by the patentee, that the rats which eat the poison carried the disease to others, was, I think, also proved, as about a fortnight after the poison had been laid down in the goods shed sick rats were seen to come out of their holes and die in the quarters contiguous to the shed, and also to the market where the poison was laid down. On making enquiries among the shopkeepers in the market and at the goods shed, I found that the people have found a decrease among the number of rats since the poison was laid down. But it is very difficult to prove this, as you will see by the statistics supplied ; comparatively few dead rats were found about the place, but of course a number may have died in the field or in their holes.

"I do not think the test was a very fair one, as it was tried three months later than it ought to have been done. It is said on the tins ratin would be effective up to the end of April, and I did not get it till July.

"I am of opinion that ratin does what it is said to be capable of doing, viz., kill rats and cause an epidemic

among them, and I think it would be a good plan to try it again. I did not try it in private houses as I was afraid the children would eat it, the smell being rather sweet and the poison having the appearance of native sweetmeats. I would recommend that ratin be brought and tried during 1908, but would urge the necessity of it not being delayed in transit, and that it be tried during the cold weather, as I have no doubt it will act much better.

" V. St. John Croley.
" *Khargpur*."

Raticide.

This preparation, very little known in this country, is manufactured in the United States, where it is sold under the name of Azra, and recommended by various authorities as a highly efficient rat exterminator.

The London branch of the firm which makes these cultures has not supplied me with any information concerning the nature of the bacillus used in raticide, but referred me to the Medical Director General of one of the Services, who sent the following report :—

" Raticide is supplied in the form of a flaky powder in 1 oz. bottles, and when used it is only necessary that it be mixed with fine oatmeal. It appears to be exceedingly valuable, but it is necessary that it be used in a routine manner, as it has been found that those places where it has been used regularly once a month have remained quite free from rats (except the kitchen). It is worthy of note that where the rats have reappeared the

majority are only half-grown. Raticide is harmless to other animals, and is not necessarily fatal to rats when fed upon it in captivity, but it causes drowsiness in which condition they are attacked and eaten by other rats, and the disease is then transmitted in a more fatal form. It appears to be more fatal to brown rats than to black, for although formerly quite as many brown as black were to be seen about, no brown ones have been seen for some time, and only a few of the black variety."

Raticide has one great advantage over the gelatine cultures of the "Virus" class: the extreme ease with which it may be prepared, but in the light of recent researches it suffers from the objection that there is no record of any official feeding tests having been made with the view to showing that it is harmless to other animals. When this has been done there is little doubt that this preparation will become one of the chief weapons in the world's war against the rat.

"Pasteur" Virus, Liverpool Virus, and Laroche Virus.

These preparations are really cultures of the *Bacillus Danyszi* sold under different names. The "Pasteur" virus is prepared in the laboratories of the Pasteur Vaccine Company, a commercial organization unconnected with the Pasteur Institute,[23] whilst it is stated that the Liverpool virus is made under the direction of Professor Annett, of Liverpool University.

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[23] Danysz Virus is made by a private firm, and not at the Pasteur Institute.

There are no published records of any official tests having been made during the last five years with any of these preparations in this country or abroad, nor have the firms interested in their sale been able, at my request, to furnish me with information concerning such tests. Experiments made by me with cultures of "Pasteur" virus, Liverpool virus, and Laroche virus, obtained through chemists, showed that these preparations possess all the disadvantages of Danysz virus, whilst the percentage of successes obtained with them in killing rats appears to be even less than of Danysz virus, which, as I have shown, is barely fifty. They may therefore be said to be of little practical value for the extermination of rats.

MUMMIED CAT.

CHAPTER V.

Conclusions.

(1) The brown rat (like the black rat) is not an indigenous animal, but invaded this country in 1732, having been brought on ships from India.

(2) It has disturbed the conditions existing previous to its arrival by—

(*a*) Exterminating the black rat, and

(*b*) Becoming a national pest.

(3) Five factors have contributed to make the rat a national pest :—

(*a*) Its physical and mental faculties.

(*b*) Its tremendous fecundity.

(*c*) The increase in the human population (hence more shelters and more food stores).

(*d*) The killing, by gamekeepers, of the rat's natural enemies—the weasel, the owl, and the kestrel.

(*e*) The total absence of co-operation in the methods chosen by man to exterminate the rat.

(4) As a result of these factors operating in favour of the rat, there are to-day, in this country, at least 40,000,000 rats, which do every year a damage amounting at least to £15,000,000.

(5) In addition, the rat is guilty of being the chief agent in the spread of trichinosis (by acting as host to the trichina), and of the bubonic plague (by acting as conveyor of the plague flea).

(6) The destruction of rats becomes, therefore, a matter of national importance.

(7) There is no ideal method for destroying rats. In this war of man *v.* rat any method is good as long as it kills rats, and is used persistently and in co-operation with similar efforts made everywhere else.

(8) Nothing but a national campaign, waged with all the weapons available, can bring about the destruction of the brown rat, but this co-operation can be effected only by the State.

(9) The State already undertakes, through the Port Medical Officers of the Local Government Board, the destruction of rats for hygienic reasons, and, through the Board of Agriculture, the destruction of injurious insects. The destruction of rats for economic reasons is therefore only the natural development of the present duties of the State.

(10) A short Act, based upon the Danish Rat Law, making it compulsory for county councils and municipal authorities to destroy rats, would probably effect the practical extermination of the rat in this country in ten years.

(11) An annual expenditure of £50,000 would probably result in saving the greater part of the enormous loss inflicted by rats.

(12) This annual grant should be expended partly

on premiums—from 1d. to 2d. for each dead rat handed in—partly for experiments, on a large scale, with such bacteriological preparations as may be selected on the grounds of harmlessness to other animals, high efficiency, and easy application.

(13) Such Rat Law should contain a clause protecting, during the five years following the passing of the Act, or for a longer period, all weasels, owls, and kestrels.

(14) Pending the passing of such law, public spirit should support the scheme of the Incorporated Society for the Destruction of Vermin of a National Rat-killing Competition, by means of clubs which it is intended to create by the offer of £300 in prizes.

CHAPTER VI.

APPENDIX.

I.—Rat Law of Barbados.

Barbados. No. 192.

An Act to Encourage the Destroying of Rats in this Island.

Whereas the amount of damage having been done to the Inhabitants in general by the increase of rats in this Island: in order that all proper encouragements might be given for the destruction of the said vermin: An Act passed the Legislature of this Island, the Sixth day of April, One thousand seven hundred and forty-five, entitled: *An Act to encourage the destroying of rats in this Island,* which was to remain in force for three years from the publication thereof and no longer; and as the said Act is now expired and it is still necessary to provide a proper encouragement for the destruction of the said vermin of Rats which do great damage to the inhabitants, be it enacted by his Excellency Henry Grenville, Esq., Captain General and Governor-in-Chief of this and all other His Majesty's Caribbee Islands to windward of Guadeloupe, etc., the Honourable the Members of His Majesty's Council, and the General Assembly in this Island, and by the Authority of the same, that the Church-Warden of every Parish in this Island shall immediately pay to any person, white or black, for the head of every Rat caught or killed in the Parish, and produced and left with him, who is to mark them in such manner as to prevent the same being doubly paid for, two-pence; and if the Church-Warden shall neglect or refuse to pay same immediately he shall forfeit and pay to any white person complaining, or to the owner of such slave as shall produce the heads

of any Rats, the sum of three pounds current money; to be covered before any Justice of the Peace and raised as in case of Servants' Wages. And be it further enacted by the Authority aforesaid: That the like allowance shall be made and paid for every Rat that has been caught and killed and produced as aforesaid since the expiration of the said former Law: And that the Church-Warden for the time being shall, and he is here required to, pay and allow to any creditable white person what it shall appear on oath to the said Church-Warden such persons had advanced and paid to any other person for any Rats caught or killed in the parish, and marked in such a manner as not to be doubly paid for: And on refusal of such Church-Warden so to do, the sum justly due shall be recovered of him as in the case of Servants' Wages, by the person advancing and paying the same.

II.—Rat Law of Antigua.

No. 19 of 1880.

An Act to Encourage the Destruction of Rats in this Island.

(1) One penny per head upon each rat destroyed.

(2) Treasurer to supply Inspector of Police with necessary funds upon the Governor's warrant.

(3) Books to be kept at the Police Stations.

(4) The books at the Police Stations to be examined by the district magistrates.

(5) Land tax to be increased.

(6) Duration of Act.

Be it enacted by the Governor and Legislative Council of Antigua as follows:—

(1) The Officer in charge of every police station shall immediately pay to any person for the head of every rat produced and left with him the sum of one penny, provided that such officer

shall not be required to accept and pay for a less number than six at any one time.

(2) The Treasurer, upon the warrant of the Governor, shall provide the Inspector of Police with such sums of money as may be necessary to make the payment required by the first section of this Act, and the Inspector shall, out of the sum so provided, furnish the officer in charge at each of the said police stations with such sums of money as may appear to be expedient and requisite for the due carrying out of the purposes of this Act.

(3) A book in the form set forth in the Schedule shall be kept by the officer in charge at each of the said police stations, in which he shall duly enter all moneys received by him from the Inspector of Police, and the moneys paid away by him and the names of persons to whom such payments have been made.

(4) The district magistrate shall from time to time examine the entries in the books kept at the police stations.

(5) There shall be added to the land tax as long as this Act is in force, and for the purposes of this Act, an additional impost of one penny per acre on all cultivated land and of one halfpenny per acre on all uncultivated land, which said additional tax shall be levied at the same time and in like manner as the land tax.

(6) This Act shall remain in force, unless sooner repealed, for the space of three years from the date thereof.

SCHEDULE.

Accounts of Receipts and Disbursements at .....Police Station, under Act No. 19 of 1880.

Dr. *Cr.*

Date of receiving amount from Inspector	Signature of officer receiving amount	Amount	Date of payment to Rat-catchers	Person to whom paid	Number of Heads	Signature of Recipient	Amount

III.—Rat Law of Hong Kong.

Whereas there is reason to believe that in certain circumstances rats are instrumental in spreading the plague, and whereas it is expedient to minimize their numbers and destroy them both on shore and in vessels in the harbour, and to prevent their access to the shore from vessels or to vessels from the shore, &c.

Be it therefore enacted by the Governor of Hong Kong, with the advice and consent of the Legislative Council thereof, as follows :—

(1) This Ordinance may be cited as the Rats Ordinance, 1902.

(2) In this Ordinance, unless the context otherwise requires, "vessel" includes any ship or boat of any description or vessel used in navigation.

(3) It shall be lawful for the Governor-in-Council to make from time to time such regulations as he may deem expedient :—

(*a*) With regard to rats and the means and precautions to be taken, on shore or on board vessels in the waters of the Colony, to minimize their numbers and to destroy them, and to prevent them from passing from such vessels to the shore or from the shore to such vessels.

(*b*) For the better prevention of the danger of the spreading of infection by rats.

(4) If any person commits a breach of any such regulations, that person shall for each offence be liable, on summary conviction, to a penalty not exceeding a hundred dollars, or in default of payment to imprisonment, with or without hard labour, for a period not exceeding one month.

(5) Any regulations made under the provision of this Ordinance shall not take effect until they have been published in the Gazette.

IV.—Rat Law of Denmark, 1907.

1.

When an Association constituted for the purpose of effecting the systematic destruction of rats has proved to the satisfaction of the Minister of the Interior that it is in a position to expend on the furtherance of its objects, within a period of three years, a sum of not less than 10,000 kroner per annum, it shall become incumbent upon each local authority to make suitable arrangements at the expense of the local funds, and commencing with a date to be made known hereafter by the Minister of the Interior, for the reception and the destruction of all rats killed within the district of such authority and delivered up to such authority.

For each rat delivered up each local authority shall pay a premium, for the payment of which an annual grant shall be made out of the local funds, which shall not be less than three kroner per each hundred inhabitants within the district of each local authority, according to the last general census.

The State shall make for a period of three years an annual grant of 30,000 kroner, of which one-third may be expended on scientific experiments with preparations for the extermination of rats, under the control of, and in consultation with, the Royal Veterinary and Agricultural College, whilst the remainder shall be expended on purchasing preparations for the extermination of rats, which shall either be employed on or in public lands or buildings, or out of which remainder grants may be made to associations towards the purchase of such preparations, in a manner to be defined hereafter by the Minister of the Interior.

2.

Each local authority shall fix the amount of the premium (Section 1) which shall not, however, be more than ten œre or less than five œre.

Instructions for the collection and destruction of the rats killed will be issued by the Minister of the Interior.

3.

The Association cited in Section 1 shall submit for the sanction by the Minister of the Interior at the beginning of each year a plan showing the proposed expenditure, and at the end of each year an account of the money expended by it, together with statistics obtained by it, showing the expenditure on premiums made by each local authority.

4.

Where the proprietor or occupier of a messuage has participated in the grant to be made by the State (Section 1), he shall not deliver up, or cause to be delivered up, for the purpose of obtaining premium or premiums, rats killed within the said messuage, until the expiration of one month from the employment of such preparations for which such grant has been made. Any person acting in contravention of this Section shall be liable to a penalty of 100 to 500 kroner.

5.

Any person who preserves or breeds rats or imports rats from abroad, in order to obtain premiums or enable another person to obtain them, shall be liable to a penalty of 100 to 500 kroner, unless he is liable to a higher penalty under the Common Law. A person who shall deliver up rats knowing them to have been preserved, bred, or imported for the purpose of obtaining premium shall be liable to the same penalties.

All proceedings under this Act shall be taken in a public Police Court, the fines to go to the special funds provided by this Act, or, where such fund does not exist, to the public funds of such local authority.

Any person delivering up rats to any other local authority than to that within the district of which they have been caught shall be liable to a penalty not exceeding 100 kroner.

This Act shall come into operation on a date to be fixed hereafter by the Minister of the Interior, and remain in operation for three years. In the Session of the Riksdag immediately preceding the expiration of this Law, a vote shall be taken for the renewal or revision of this Law.

The Government is authorized by Royal Rescript to make such alterations in the operations of this Law within the Faroe Islands as may be considered most suitable, having regard to the special conditions obtaining within those islands.

Given at Amalienborg, the twenty-second of March, Nineteen hundred and seven, under our Royal hand and seal,

FREDRICK R.

SIGURD BERG.

V.—RAT LAWS OF BARBADOS, 1908.

1908-31.

AN ACT TO ENCOURAGE THE DESTRUCTION OF RATS.

(July 30th, 1908).

Be it enacted by the Governor, Council, and Assembly of this Island, and by the authority of the same, as follows :—

Short Title.

(1) This Act may be cited as the Rat (Destruction) Act, 1908.

Payment of One Penny for Each Head and Tail of every Rat.

(2) (i.) The Parochial Treasurer of each parish, or in case the Parochial Treasurer of any parish shall be unwilling to undertake the duties imposed on him by this

Act, then the person or persons nominated by the Vestry and approved by the Governor-in-Executive Committee shall immediately pay to any person, on his written receipt for same, for the head and tail of every rat produced and left by him with such Parochial Treasurer, or such person or persons nominated and approved as aforesaid, the sum of one penny out of the funds in his hands mentioned in section 3, hereof, and shall effectually destroy every head and tail so paid for.

Commission to be allowed Parochial Treasurer or Person appointed for paying such sums.

(ii.) The Parochial Treasurer of each parish, or the person or persons nominated and approved as aforesaid, shall receive as remuneration for the services performed by him a commission of ten pounds per centum on the amounts paid out by him under the preceding subsection.

Money to be paid from Treasury on Warrant of Governor in Executive Committee.
To be duly accounted for to Auditor-General.

(3) The Governor-in-Executive Committee is hereby authorized and empowered by warrant to direct payment out of the Public Treasury of such sums of money not exceeding ten pounds at one time as may from time to time be necessary to the Parochial Treasurer of each parish, or the person or persons nominated and approved as aforesaid to be by him expended in carrying out the provisions of subsection i. of section 2 of this Act and such sums of money shall be duly accounted for by him to the Auditor-General, and the payments thereout certified by him according to the form contained in the Schedule to this Act.

Duration of Act.

(4) This Act shall continue in force for three months from the date of the commencement of the Act.

Read three times and passed the General Assembly this Twenty-first day of July, One Thousand Nine Hundred and Eight.

F. J. CLARKE,
Speaker.

VI.—DRAFT OF THE ENGLISH RAT LAWS.

AN ACT TO PROVIDE FOR THE DESTRUCTION OF RATS.

Be it enacted by the King's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

Local Authorities to Execute Act.

(1) Where the local authority are informed by any person that any place or area within their jurisdiction is a rat-infested place or area, it shall be the duty of such local authority to enquire into the truth of such information, and if it is found to be true, to take such measures as may be deemed advisable for the destruction of the rats in such area.

Local Authority may Appoint Officers.

(2) For the purpose of carrying out this Act the local authority may, with the consent of the Local Government Board, appoint any person or persons whose duty it shall be to destroy the rats found in the area of the local authority. The local authority may also, with the consent of the Local Government Board, pay any person proving

to the satisfaction of the local authority that he has killed rats within its area such sum as the said local authority shall from time to time direct.

Power for Local Government Board to carry out Act.

(3) If the local authority decline or neglect to carry on the duty imposed upon them by Section 1 of this Act, the Local Government Board may at any time, if they think fit, on any evidence satisfactory to them, declare any area to be a rat-infested area, and may give the local authority twenty-eight days' notice in which to take effectual measures for the destruction of the rats in such area. And in case the local authority still declines or neglects to carry out its duty it shall be lawful for the Local Government Board to take such steps as it may deem advisable to carry out the duty imposed upon the local authority by Section 1 of this Act.

Repayment of Money expended by Local Government.

(4) All sums expended by the Local Government Board in the carrying out of such duty shall be refunded by the local authority.

Power of Entry by Officers of Local Authority.

(5) A sanitary inspector or an inspector of nuisances, or an officer appointed by the local authority for the purpose of destroying rats, may, without a warrant, enter any place or area suspected of being a rat-infested area or place, and any person who obstructs him in the execution of his duties shall be liable to a fine not exceeding £5.

Damage to Buildings.

(6) The local authority shall not be liable for any damage done to buildings or other property caused by any of its

officers in the execution of their duty unless it can be shown to the satisfaction of a Stipendiary Magistrate, or two Justices of the Peace, or a County Court Judge that such damage was unnecessary. And any owner of such buildings or other property, and also the local authority, shall have a right to appeal from the decisions of any Stipendiary Magistrate or two Justices of the Peace to a Court of Quarter Sessions, and from the decision of a County Court Judge to the King's Bench Division of the High Court of Justice.

Interpretation.

(7) The words "place or area" include dwelling-houses, out-houses, factories, warehouses, docks, wharves, railway stations and buildings attached thereto, stables, sewers, fields, gardens, and stacks of wood, hay, and corn.

The words "local authority" mean County Councils, City Councils, Borough Councils, Urban District Councils, and District Councils.

(8) (i.) This Act may be cited as the Destruction of Rats Act.

(ii.) This Act shall come into operation on the 1st day of October, 1909.

CHAPTER VII.

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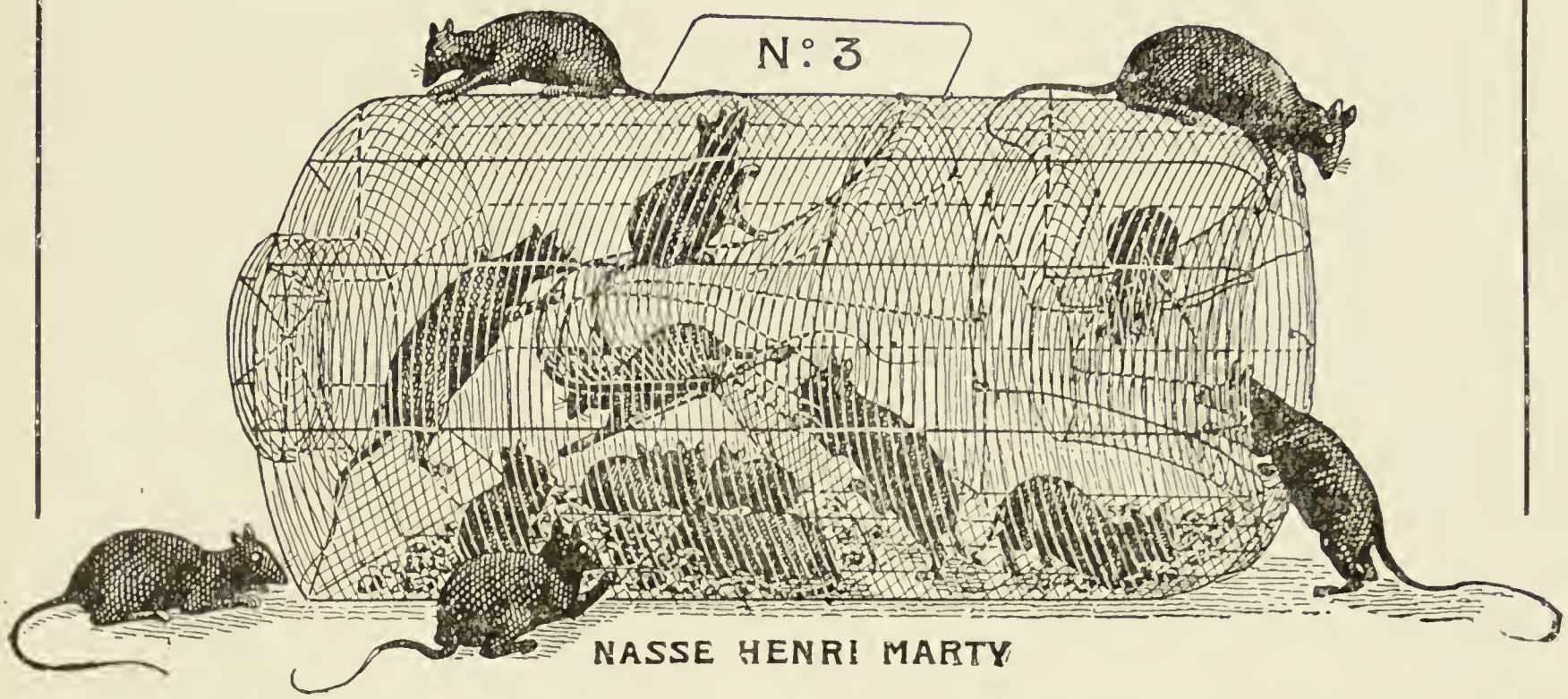

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